JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE

State of Pennsylvania,

AND

AMERICAN REPERTORY.

SEPTEMBER, 1842.

Civil Engineering.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Cost of Transportation on Railroads. *By* C. ELLET, JR., *C. E.*

I have never yet seen any formula, derived from the experience of active lines, by which the cost of transportation on railroads may be determined with an approach to accuracy. The expenses of maintaining a line of railroad are not *all* proportional to the distance traveled by the locomotive engine, nor to the tonnage conveyed; neither are they all independent of either of these considerations. But the aggregate annual cost is made up of certain items, which are, in fact, nearly proportional to the distance run by all the engines; of others which are strictly proportional to the tonnage conveyed; and of some which are nearly, or quite, independent, both of the trade and of the distance traveled.

I offer the following rule for the determination of this aggregate, in the belief that every well managed railroad, of ordinary construction, carrying engines of ordinary power, where the transportation is effected at the usual speed, and which accommodates a respectable amount of business, will exhibit results in close agreement with its indications. This formula is derived from the considerations which follow, and the constant quantities are supplied from the best experience I have been able to obtain from the past management of the public works of this country. In course of time, when the velocity of burthen trains is reduced to three or four miles per hour, and companies learn to know where and how to economize, it is probable

that some of the items may be reduced; but time and experience have yet to decide how much.

I. *Repairs of Road.*—The repairs of a railroad consist of two distinct divisions; the first of which is nearly independent of the amount of the trade, and may be estimated, on the average, at about $500 per mile. The second division is dependent on the amount of the tonnage, and represents the injury done to the road by the passage of one ton of freight. I estimate this wear and tear at $\frac{35}{100}$ of a cent per ton per mile.

II. *Expense of Cars.*—The expense of repairing and renewing the burthen cars is proportional to the distance which they run, or to the tonnage of the line; and may be estimated at $\frac{45}{100}$ of a cent per ton per mile.

III. *The expense of agents, conductors, the force at depots, breakmen, and contingencies of all sorts,* is likewise nearly proportional to the business of the road, and cannot be assumed at less than *six mills* per ton per mile.

IV. *Locomotive Power.*—The expense of repairs and renewals of locomotive engines and tenders, the cost of fuel, and the pay of enginemen and firemen, are nearly proportional to the distance run, and may be estimated at *thirty cents* per mile traveled by the engine.

Now, to express the cost of maintaining a line of road, under good management, for one year, let us represent by

N the number of miles run by all the engines;

T the whole number of tons net conveyed one mile; and

h the length of the road in miles.

Then, according to the foregoing data,

$$\frac{3\,N}{10} + \frac{14}{1000}\,T + 500\,h.$$

will be the aggregate annual cost in dollars, (where the business consists exclusively of tonnage,) of maintaining the line and its equipage.

If the road accommodates a mixed business, of trade and passengers, to obtain the aggregate expense, we must add $\frac{1}{100}$ P—where P represents the whole number of passengers carried one mile.

This formula takes proper account of the difference of grades, but is not applicable to very short roads—to roads doing a very inadequate business—by which I mean less business than can be accommodated by one engine—nor to the first four years' operations, while the road, cars, and locomotives, are yet all new.

By applying this rule to the active lines of the country, it will be found that the larger establishments—those which possess a valuable trade—give very similar results.

There are none on which the expenses fall within the limit assign-

ed by the formula, excepting, perhaps, one or two which have been recently completed, and on which the cost of renewing the iron, timber, bridges, cars, and locomotives, is not yet very sensibly felt. It will be found to suit those cases better a few years hence.

[To be continued.]

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Reply to the Notice of the "Projected Water Works at Albany, New York," published in the Journal of the Franklin Institute, vol. iii, 3rd series, page 380.

The following remarks are submitted in reply to strictures upon my Report on the Albany Aqueducts. Without intending anything disrespectful to the courteously expressed opinions of the writer, I may be allowed to say I am rather pleased the plan should have met with opposition—as this, I believe, has invariably been the fate of every new plan, of much importance, which has at any time been brought forward. I have only to regret that such extracts did not accompany the review as would have placed at least the main features of the plan before the reader in a perfectly *intelligible* shape; had this been done, present remarks would have been less necessary, as I trust to show, in a brief space, that the opinions advanced are *imaginary*, and rather the result of *misconstruction* of the nature of the *plans proposed*, or of *misconception* of *what really are the results of practice* on the part of the writer, and the practical friends consulted, than of any over-adherence on my part to "the theory of the question."

I. He cites a trial at Fairmount as a "stubborn fact," proving incontestibly that, *in practice*, water cannot be made to rise, in a jet, over three-eighths of the height of the fountain, or reservoir, and of course that the plan I proposed of making the head of water available for the extinguishment of fires, and which anticipated a jet rising much nearer the level of the reservoirs, must be wholly inefficient.

Now the *essential circumstance* of the trial having been made with a single adjutage of one inch diameter, has been entirely overlooked; while it is a "stubborn fact" that with a plentiful supply of water, and given height of fountain, *the height of the jet may be increased* through a very great range, simply by varying the size of the orifice of the adjutage. My plan had due reference to this appropriate orifice for the jet, and the writer's opposition to it arises from want of knowledge of any such requirement; in other words, from mistaking an *individual fact* for a *principle*, and resting his opinion entirely upon the *imaginary* strength of a trial, which could decide *nothing* except the naked fact that, with exactly the same plan and

arrangements, a jet of but thirty feet only can be produced. There can be no hazard in expressing the opinion that the head of water at Fairmount is capable of forcing up a jet of at least double this elevation.

Not to expatiate further on this, I will but mention some recent trials, which confirm, decisively, all the views put forth in my Report to the Common Council of this city. It is but a few days since jets of one hundred and fifteen feet were produced at the Haarlæm River, on the Croton Aqueduct; which proves that after allowing for the difference in the elevation of the fountains, all my anticipations will be *at least fully realized.* For the matter of that, the elevation of our fountain being two hundred and sixty feet above tide level in the Hudson, (nearly twice that at Haarlæm, and more than three times that at Fairmount,) I had all along anticipated much greater things than has recently been done at Haarlæm, in the lower part of the city, which contains the bulk of population, where I had no doubt we should be able to cast a jet over the spires of the churches.

II. The writer does not comprehend my plan. Every part of the conduit, except the brief length of the depurating sections, is graded, and descends from the reservoirs, and lies within fifty-five feet of the level of the fountains. Ventilators cannot, in any event, be requisite at more than two points, and can be effected at so small an expense, as not to be worth mentioning—any expense of this description being fully covered by, and provided for, in the allowance for contingencies in the estimates of cost.

III. The writer has again misconceived my plan. The *depurating sections* were subordinate appendages, established only where my plan of *grading the profile* required the level of the conduit to be *sunk;* and the only addition of expense on these sections was for "*roil-chambers,*" which were intended "to obviate all risk *from* deposition of sediment in the duct, and of interruption to the regularity of the supplies, &c.; to give absolute control over whatever of sediment the water might contain after being introduced within the conduit, and to provide for its removal from the conduit before reaching the city, at given periods," &c. Does the writer in the Franklin Journal hazard the opinion that in case of such deposites (which he admits do take place in the Philadelphia conduits, and of which I gave an instance in my Report, on a small, but still practical, scale,) the simple force of a current of one mile and a quarter per hour in the conduit, would be sufficient to *force* the sediment up the banks of a gulf rising eighty feet, at an angle slightly less than forty-five degrees; or that simple cocks, without any enlargement of the section of the conduit, would not require *frequent attendance at each, and*

be both troublesome and expensive to manœuvre; or that an enlargement must of necessity *sensibly* check the flow of the water? The roil-chambers do not demand constant attendance, and their cost could *not exceed the expense of cocks*, properly guarded from freezing up, as they must be to be of any practical value.

The mode of venting this, besides, gives at all times perfect command over the whole of the water in the conduit, and there are various ways in which this quality alone may promote the efficiency of the aqueduct.

IV. With regard to the thickness of the conduit, I have to remind the writer that he does not show that the *practice* in Philadelphia is founded upon any exact knowledge of their capacity to sustain a determinate pressure, or head, of fluid, with a given size of pipe. He is, doubtless, aware that the authority of *practice* is little more than the authority of *conjecture, where not so founded.* He admits, besides, that the pipes are actually tested at a pressure more than five times greater than the head they actually had to work under; that "they rarely fail, and that it may be said with truth, these failures usually occur at imperfections."

This is candid. Will the writer be good enough to define what degree of excess of thickness will always make pipes secure, on the supposition that they fail only at imperfections? If a part of the Water Works at Philadelphia had been laid with pipes of two-thirds of an inch thick, a part with pipes of half an inch, another with pipes of one-third of an inch, &c., something determinate, it is conceded, might have been concluded from the practice there. Had this been done, it would have been found that the least thickness would have stood equally well with the greatest; and that failures only occurred where imperfections existed at the time of laying them down; and *the practice would now be* to lay only the thin pipes—that is, it would have been so had further provision been made against corrosion of the pipes by rust, agreeably to the plans proposed in my Report.

I am not positive, but believe that the pipes of the conduit at Haarlæm, now on the Croton Aqueduct, are the three feet pipes which are ultimately to surmount the high aqueduct bridge over that river. They are now *actually working* under a head a great many times greater than can ever come upon them when occupying the position they are intended for. The actual head has been stated at one hundred and forty feet; consequently, if not mistaken in the size of the pipes, they are now actually working with *considerably less* than the equivalent of a quarter of an inch for a seventeen inch conduit, under a head of fifty-five feet. This is decisive as to the thickness *actually* required in practice.

The enormous surplus put into the Philadelphia pipes, merely to guard against an occasional imperfection, (which experience proves it fails to do,) seems to be but little more consistent than to add to that still more in order to render it impossible, in case of invasion of the good city of Philadelphia, for the enemy to uncover and fracture the conduit, by sledging.

The candor of the writer will now concede, I think, that the practice at Philadelphia does in nowise negative the dimensions assigned in my Report on the Albany aqueducts, and that other works, on a still grander scale, *fully confirm* their efficacy at least; and, consequently, that *actual practical cases* afford sufficient evidence that my estimates of the cost of erecting the conduit, are at all events *not too low.*

V. With regard to the length of the links of conduit, I have nothing to reply, but to state that when skilful founders shall, under the inspection of the writer and myself, make an attempt, with additional sprues, &c., another expedient a little out of the usual routine, (as was suggested by Mr. J. Rogers, one of our most skilful machinists, and himself an experienced founder, as the means of meeting the difficulty of casting thin pipes,) and shall fail in ability to produce links of fifteen feet, I will cheerfully surrender my conviction, on this head, to the writer, and use lengths of ten feet.

VI. It is certainly true, in theory, that the protecting metal in a galvanic circuit is in itself liable to corrosion; but is not the writer in the Franklin Journal aware that this is not always necessarily so *in practice?* and, with regard to zinc, particularly, we have the authority of Sir Humphrey Davy (who determined the question in the most explicit manner, with express reference to an equally important and practical subject,) that after the first coating of oxide has formed, that that coating effectually protects the zinc from further detriment, while the iron remains perfectly under the influence of the galvanic action excited.

But the writer has, besides, misapprehended my object entirely. I did not propose zinc as a better material than lead for simply *closing and securing the joints*—nor yet because it was cheaper. Perhaps no metal whatever can afford a more perfect joint than lead, as regards both "tightness and durability." My object was much more important than either of these. I proposed to employ it *solely on account of its protecting quality*, with the view of dispensing with the enormous quantity of material usually put in the body of pipes, considering that if the oxidation of the metal were arrested, surplus beyond a certain thickness could serve no useful purpose.

The writer is too liberal, I think, to object because I kill, as it were,

two birds with one stone—the plan proposing to arrest the corrosion by the same operation which closed and secured the joints.

As regards the great expense of sealing with zinc, the writer forgets that a given volume of zinc does not weigh more than two-thirds as much as the same volume of lead, and, consequently, that ninety-four and a quarter pounds of lead are required for sealing the same joint that sixty pounds of zinc would secure. The prices of the two metals being nearly inversely as the weights of metal required, leaves the expense of sealing a joint about the same, which ever metal is used. But even if this were not so, the object with which the metal is employed is a paramount consideration.

VII. As regards the velocity of the pistons of the elevating machinery, I beg leave, with due deference, to say, I cannot perceive any force in the writer's theory as to "the momentum not being kept up whilst the piston clears the dead points, &c." The writer, in the fervor of his affection for the Philadelphia works, seems to think these works a model of perfection, which can in no respect be departed from without "practical error." Beautiful and useful as are the celebrated works of Fairmount, I must be permitted to say that the writer entertains very erroneous and unsubstantial views when regarding them as paragons of perfect skill. That the whole works of that city might have been made vastly more useful and efficient, at an expense very much less than they have cost for construction, I cannot but think must be apparent to every person capable of understanding and appreciating the discussion which the writer's critique has produced.

That there are other *very* important points of difference between the projected Albany works and those at Fairmount, is a truth of which I was aware at the time of proposing my plans last autumn; but these, like the rest, were designedly so, though in nothing which is not justified by the errors of practice.

WM. MCCLELLAND CUSHMAN, C. E.

Albany, New York, July 22nd, 1842.

Facts and Observations on Four and Six Wheel Engines.

By JOHN HERAPATH, ESQ.

[CONTINUED FROM PAGE 79.]

North Midland Railway.

We believe that this line was originally projected by Mr. Henry Patteson, the late Secretary, and Mr. George Stephenson, the Engineer. It unites Derby with Leeds, and forms part of the main trunk line to the north of England, on the east side of the island. Its length is 72¼ miles, and it joins on the south at Derby and Midland coun-

ties, and the Birmingham and Derby Junction Railways; and on the north, the Manchester and Leeds, Leeds and Selby, and York and North Midland.

One of the most troublesome works upon this railway was the Clay Cross Tunnel. In fact, it was almost another Kilsby affair; and even now is a constant source of annoyance from its gradient and the wet, which oblige the engines passing one way through, that is from Leeds towards Derby, to be always using the sand-hoppers to give bite to the wheels.

On this line I observed a peculiarity in the mile posts which I do not remember to have seen on any other line, and with which I was much pleased—that is, the mile posts have large round heads, by which they are immediately known, even in the night; and the ¼, ½, and ¾ mile, were simply straight posts. The mile posts have marked upon them the gradient of the place, with a line between the figures, inclined to the horizon in such a way as to show which direction the ascent or descent takes. Simple as this contrivance appears to be, it is very useful to travelers, and it might be advantageously introduced upon all railways. We believe it was designed by Mr. Robert Stephenson, the engineer of the line.

A remarkable feature on this line is the stations; perhaps the neatest that I have seen upon any other line of railway. The average cost of them, I understand, is about £3,000 each. But of all railway stations, that at Derby claims most the traveler's attention. It was stated to me that it stands upon about 33 acres of ground, and cost nearly a quarter of a million of money. The extreme length of the shed is 1,050 feet; and breadth, 140 feet. It appeared, I thought, to be inconveniently long; but I was informed that it was often filled from end to end with carriages. The business of all the three Companies is here carried on by the North Midland Company. I had no opportunity of going much over the offices, but from what I saw of them, I thought them pretty well laid out. Their only fault appeared to be that they were rather too capacious, which is, perhaps, erring on the right side. I went over the store department, under the management of Mr. Finlayson, and was exceedingly pleased with the order, regularity, and systematic manner in which the stores were kept. Every item had its separate and appropriate place; and there was not a nook in his offices which was not advantageously occupied.

Their workshops are upon the plan of the Wolverton establishment, as might have been expected from Mr. Glyn having presided over both Companies; but they have not yet arrived at that maturity in their machinery, &c., which the London and Birmingham Company have.

Here I had an opportunity, through the politeness of Mr. Finlayson, of seeing Mr. Edmonson's plan for printing and numbering railway tickets. Some idea may be formed of the utility of this invention, from the fact that it printed and numbered consecutively from 4 to 49 in one quarter of a minute, or above three in one second—the man not working the machine over fast. It is, certainly, a very simple and useful invention.

The Midland counties locomotive establishment here is not on so extensive a scale, but, from the cursory view that I took of it, it appeared to be more matured. I had no opportunity of going over the Derby Junction locomotive establishment, as I was suddenly called to town.

Monday, Nov. 6, I came in upon this railway at Leeds, on my return from the north.

Their engines are all distinguished by numbers, as on the London and Birmingham Railway. I got upon No. 7 engine—6 feet driving wheels, eighteen inch stroke, 14 inch clylinder. She certainly was not one of the most steady engines that I have been upon, nor one that I should at all call steady. The next day I took a trip with Mr. Marshall, the superintendent of the North Midland locomotives, from Derby to Masborough, and returned on No. 19, an engine by Robert Stephenson. This was a much superior engine to the last, in point of steadiness and ease of motion. She had none of that pitching and working against herself, nor any of that wriggling motion of the former. I understand that she was one of Stephenson's latest engines.

As the engines on this line are all six wheeled, and of nearly the same pattern, I did not think it necessary, particularly as my attendance in town was required, to go upon more than the two I had tried.

Their stock of engines consists of 30 passenger engines, uncoupled; and 10 good engines, coupled. They are all six wheel engines, with outside bearings. Seventeen engines have six feet driving wheels, and four feet leading and trailing wheels, with 14 inch cylinders and 18 inch stroke. Their weight is 18 tons in a working trim—that is, 8 tons on the driving wheels, 6 on the leading, and 4 on the trailing wheels. Three engines are exactly similar to the above, except having wheels 6 inches smaller in diameter. Ten engines have 5 feet driving and leading wheels coupled together, with 3½ feet trailing wheels. In other respects they are similar to the former. Ten engines have 5½ feet driving wheels, and 3½ feet leading and trailing, with 13 inch cylinders, and 18 inch stroke. The weight is 15 tons, distributed in proportion to those of the 17 engines above mentioned.

Of these 40 engines, 30 are in a fit state to take a train. The driving wheels have no flanches, and the coupled engines are said to work very satisfactorily.

The gross average load of the passenger trains, including engine, tender, and empty carriages, is 60 tons; and 150 tons the goods trains.

There have been about 30 detentions of trains from partial derangement of the engines, one third of the causes of which occurred in the boiler and wheels, another third in the cylinders, and the last third in the valves and pipes. In one year and a half there have been three broken crank axles while running, and three others were replaced before they were broken through. Those running were unable to proceed with their trains, but stopped in a short distance, without getting off the rails, or any accident to the passengers. Mr. Marshall said the axles broke from the imperfect welding of the iron, or flaw in the crank. These accidents all happened with uncoupled engines,

two on a straight line, and one on a curve. There have been no engines run off the line. The axles which broke were 5½ inches diameter; the driving wheels 6 feet, 14 inch cylinder, and 18 inch stroke, with a steam pressure of 60 lbs. in the boiler, which appears to be the average pressure of their engines.

The average cost of the engines is £1,600; the consumption of coke, 33 lbs. per mile for the passenger engines, and 50 for the goods engines, or 40 for the average, and 46 per mile consumption of the regular trains, including pilot and assistant engines. The general character of the engines is stated to be steady in their motions. They are 18 feet long, and 11½ feet distance between the extreme axles. They have no proof that the distance of the cranks from the middle of the axles produces any sinuous motion.

The total number of miles run per annum is 600,000, or 15,000 per engine per annum, at an expense of 3¾d. per mile each engine. I suspect this is for the repairs only. The age of their engines is all one year and a half.

Each engine takes two trips per day, of 73 miles, or 146 miles daily; and their average time of work is three days out of four.

Great North of England Railway.

All the passenger engines of this Company, except two built by Robert Stephenson, are made to a pattern engine furnished by Hawthorn & Co. They have 12 inch cylinder, 18 inch stroke, and 5½ feet driving wheels. The distance between the leading and trailing wheels is 10½ feet; between the centres of the cylinders, 1 foot 11 inches, which accounts for the rather unusual height of the boiler, which I noticed above the framing. They run from one end of the line to the other, and back, daily—90 miles—and stay in one day out of four, for repairs, &c.

The merchandize engines are also built to a pattern furnished by Hawthorn & Co. The front and driving wheels are 4½ feet diameter, and coupled. They are principally used in taking coals to the depôts along the line, and consequently have no regular daily distance to run, but remain one day in five in the shed, to clean and repair. They draw from 26 to 36 coal wagons, each weighing, when loaded, 5¼ tons; and, of course, have the wagons to bring back empty.

Their stock of locomotives consists of 12 passenger, and 20 merchandize engines—including two ballast engines, used in forming the line, which are at present out of repair. They are all six wheel engines, and all have outside bearings, except two passenger engines, which have additional inside bearings on the crank axle. Their engines have not been weighed. The gross average load of the passenger trains is 50 tons, and of the merchandize 130. Twenty of these engines have four wheels, coupled, which are found to work steadily and safely; but they are only used at slow speeds. All the engines but three have flanches on the driving wheels. With the exception of four, and the two ballast engines mentioned above, they are all in a fit state to take a load. Twice only have the trains been detained from the failure of machinery—in one case from a broken piston, in

the other from a burst tube. They have had no broken crank axles, nor any instance of engines having run off the rails, except from neglect of points or switches, or through collisions. The average cost of their engines is from £1,500 to £1,700 including tender. Average consumption of coke from 36 to 38 lbs. per mile. The engines are described to have scarcely any motions, except what may be attributed to imperfections of the road; nor have they any top-heavy engines. The total daily run of the passenger engines is 450 miles, and of the merchandize, 320—exclusive of ballast engines. The steam pressure is from 50 to 55 lbs. per square inch. At present the expense of repairs cannot be ascertained, on account of the line having been opened so recently.

London and South Western Railway.

The delay in giving my account of this railway has arisen from having learned that they have four as well as six wheel engines, which I was very desirous to try together on the same line. This line, which was originally laid out under the name of the London and Southampton Railway, was evidently designed to become the grand trunk line to the west of England, and altogether to supersede the necessity of the Great Western Railway. From the detour which it makes just below Basingstoke, it was obviously meant to be extended westward, so as to take in Salisbury, and all the western parts of England, and to make the line to Bristol a branch of it. The imbecility, however, of its former management, and the extravagant expenditure of the Great Western, defeated their object, and confined them literally to the title of their line, a London and Southampton railway.

On Nov. 13th I had an opportunity of riding on three of the Company's engines. I went down to Winchester on the *Queen* engine, a six wheel, with 5½ feet driving wheels, 18 inch stroke, and 13 inch cylinder. Her weight was stated to be 14 tons 14 cwt., and the tender half the weight. Its total length was 15 feet, and the length from the hind axle to the driving axle was 5 feet 2½ inches. The hind axle to the front was 10½ feet. The coupling with the tender was rather below the driving axle. She had outside bearings, and flanches below the driving wheels. Her working time is said to be about 9 months out of 12. She consumes 17 cwt. of coke every journey of 76½ miles, and the driver said about 1,400 gallons of water. The play of her wheels upon the rails was one inch. She is considered to be a very good and steady engine. All the through engines run a journey each way daily, generally without drawing the fire. In one case I was told this engine ran about 306 miles without having the fire taken out. Each engine takes the mail train a week round. The driver of this engine, who appeared to be a steady and attentive man, and had been upon the London and Birmingham line, considers outside bearings to be more unsteady than inside. He thinks on bad roads six wheel engines are steadier than four, but admits that the London and Birmingham four wheel engines work very well. This engine appeared to me to have a sinuous motion of about two inches,

and no pitching or rolling motion. Her front springs were in a constant play, and she was easy to ride on. On curves, and drawing up hill, she appeared to be rather steadier; but in descents, at high velocities, her sinuous motion was very marked.

At Winchester I dismounted, and waited until another engine, the *Eclipse*, came up, on which I went to Southampton. This was a six wheel engine, with outside bearings, and a 13 inch cylinder; but I could not get the length of the stroke. From the hind to the driving axle she was 5 feet 1 inch, and to the front axle 10½ feet—the same as the *Queen*. Her total length was 15½ feet; she had a play of 1.2 inch on the rails. The whole of the way I rode with this engine was down hill, and at a high velocity. After making her what I thought a fair allowance for these circumstances, she appeared to me to be more unsteady than the *Queen*, and had much more sinuous motion. Her apparent sinuous motion was full three or four inches. The coupling appeared to be one foot above the driving axle, and she was pulling upwards. Probably the play of the axles on the bearings was partly the cause of her greater unsteadiness.

I left Southampton at six, by the *Orion*. It being dark, I could get no measures. She had outside bearings, and was apparently a much better engine than either of the other two, as to sinuous motion, but very disagreeable to ride upon. I rode upon her from Southampton to Basingstoke, and, therefore, had a fair opportunity of trying her both up and down hill. It appeared to me as though she had no springs behind, she was so exceedingly rough.

I traveled 106 miles on these three engines. It being dark when I was on the *Orion*, I had an opportunity of judging how far lights in front might be of any service, so as to prevent accidents. My opinion certainly is that no light, however strong, placed in front of an engine, will ever answer any useful purpose of apprizing the driver of an object before him in time to stop the train, if he is going at anything like a railway velocity. To be efficient under all circumstances, a light must be intense enough to illumine an object a mile off, in such a way that it shall be rendered visible to the man on the engine. Now, setting aside the difficulties of curves, &c., can any one imagine such a thing possible?

It has usually been said that an engine ought not to travel beyond 30 miles at a time, but this Company's engines travel two and a half times that distance, without any apparent inconvenince.

The South Western stock of engines is 48, four only of which have four wheels, all the rest being six wheel engines. The four wheel engines have inside bearings; the others have both inside and outside bearings on the crank axles. Of these engines, 42 in the middle of November were ready to take a train. The six wheel engines are said to cost £1,300; the four wheel, £1,000 each. The average gross load is 74 tons; the consumption of coke 34 lbs. per mile. They describe their six wheel engines as much steadier than their four, and prefer them on account of this quality and their greater safety; but they admit that any unsteady motions of the engines arise generally from imperfections of the road, as the primary cause. Their pressure

in the boiler is 50 lbs. per inch. The total locomotive expense per mile, 18d., and the total miles run in one year, 600,000.

They have had no engines run off the line, and have made no returns as to how many broken axles, or detentions, they have had, from partial derangement of the engines. We believe the cause for this is the destruction of their records at the late fire. At present, we understand that no Company's engines work with more regularity, or fewer accidents. Railway Mag.

[TO BE CONTINUED.]

Mr. Vignoles' Lectures on Civil Engineering, at the London University College.

[CONTINUED FROM PAGE 85.]

On Earthwork.

LECTURE V.—Wednesday, December 22nd, 1841.—The Professor commenced by stating that earthwork, taken in the present extended sense of the word, was but little known to the ancients. The gigantic operations in earthwork of modern times correspond with the viaducts of the ancients. Our earthwork may be confined to excavation, cutting, and embankment, or getting and filling, as ordinarily denominated by contractors. He then went through the whole process, giving the scientific and common names of each description of work. With respect to the works of the ancients, in the canal made by Cyrus, the Phœnicians were the only workmen who cut the canal with slopes; all the rest employed cut straight down, and, in consequence, the former stood, while the latter fell in. The River Po, in Italy, was a curious instance of embankment; this river is situated in a very flat country, and makes an annual deposit of a calcareous matter, which, hardening, raises the bed of the river in a slight degree every year. The ancient inhabitants, to prevent their country from being inundated, were obliged to raise a small embankment on each side of the river—perhaps two or three feet high—which, having served for some years the desired purpose, and the bed of the river having become higher from the deposit, the embankments required to have still more added to them, until, after the lapse of centuries, the bed of the river, from the constant deposit of calcareous matter, and the consequent necessary additions to the embankments, to the height of thirty feet, is now several feet above the level of the surrounding country. This work looks like one of our modern gigantic works, but it bears no comparison to the labors of the present day, it being but a work performed from year to year, in small portions at a time, while ours have been formed at one operation. From all his researches, he, therefore, came to this conclusion, that, until late years, earthwork was but little known; he could make the same remark with respect to cutting. This work was first treated systematically by military engineers, in fortifications on the continent, after the invention of cannon. Authors of that period lay down many curious rules for forming ramparts. Various useful calculations are given, to determine the best mode of making the matter taken from the ditch

exactly sufficient to form the rampart, in order that there should be none either to procure or to carry away. The next is in the construction of canals; the same rules were followed as in the construction of ramparts. In road-making the same calculations were made; the whole aim of the engineer being to make the imaginary line, called the "balancing line," so perfect, that the earth removed from the eminences should fill up the hollows in the irregularities of the country through which the road was to be made. The cause of these fine calculations was the difficulty and expense of carrying away the superfluous earth to another place. The absence of great undertakings on the continent is attributable to the want of our modern appliances to get rid of the superabundant matter. In the contracts sent in by foreigners for works abroad, it is amusing to see the finical exactness with which the contractors calculate the expense of removing the first 100 yards, then the next 25 yards, and so on increasing, until they get to 300 yards, beyond which the price is enormous. It is only within the last three years that they seemed to have the slightest idea of the plans in use in England for facilitating this work; it is certainly not more than thirty years ago that we commenced using the tramroad. First of all, the only plan was to remove the earth in barrows; then the clumsy three-wheel cart was introduced; after that tramroads, and now edge-rails, with the application of a locomotive—so that thirty years have changed the load from 2½ cubic yards to nearly 100.

Before railroads came into general use, deep cuttings were executed, and one remarkable instance Telford has left behind him in the Birmingham Canal, which is remarkable for boldness of idea and success of execution. Near Market Drayton there is an embankment, began fifteen or sixteen years ago, and which is as yet hardly finished, so great has been the slipping, and so difficult the remedy. This work is a remarkable instance of the combined bad effects of a bad mixture; the slopes have flatted down until nearly in the proportion of 14 to 1, and it is now more like a large hill than an embankment. There is an instance of a deep cutting, by Dodd, at the Highgate archway; it was intended, first of all, to make a tunnel, but, from the constant slipping of the earth, it was obliged to be made into an open cutting. The present bold mode of cutting down large hills, and filling up deep vallies, in the formation of railways, is due to George Stephenson, and in the construction of large cuttings and embankments for canals, to Telford, whilst Dodd made the largest cuttings for roads. On the Holyhead road the failure of the embankments and cuttings in the London clay, will teach a good lesson to the young students. The point to be considered is, which, of masonry, aqueducts, tunneling, embankments, or cuttings, would be the cheapest mode of doing the work proposed. At the present time, earthwork is the cheapest, for modern practice has reduced it to a price per cubic yard. In the contracts for the Paris and Rouen Railway, the contracts sent in by the French engineers were invariably three or four times the amount of those sent in by English contractors. Thus, notwithstanding the expense of transporting the work-

men into France, the whole of that work is in the hands of Englishmen.

The engineer, to form a just calculation, must well study the character and mechanical properties of the soil, and the necessary slopes. Experience alone can teach these points. There are many varieties of the London clay, which, when cut down to a certain depth, on exposure to the atmosphere, are sure to slip; another cause is, the great haste with which the embankments, &c., are formed. When the water does not penetrate, this clay is very hard; but after exposure, it melts away like tallow, and the only remedy is to get rid of the water by draining. When a slip takes place, the toe of the embankment bulges forward. In the first instance, the surface should be well drained a short distance from the edge—the drain to be puddled, in order that the water should not penetrate; borings should be made horizontally, and the water tapped; when expense and time are no objects, the whole should be cut in steps, and drained by means of wattles, so that if a slip takes place, it is only partial. The force with which the toe of the embankment bulges out is such, that a wall of masonry would be of no use, as it would be pushed out; the most effectual preventive, or remedy, is wattling and bush drains. When time will allow, it is better to make the embankments in layers, and between each layer of earth putting in a course of brushwood, clippings of hedges, or wattlings. When embankments are obliged to be poured out hastily, allow them to take their natural slope, and if it slips, let it remain; for however much it may be attempted to reduce it to its former shape, it will still again slip and regain its position. A good practice to provide against slips is, to form a slight abutment of earth a short distance from the toe of the slope, so that it should stay the slip if it takes place; this plan is more particularly available when the work is obliged to be erected on a natural slope —for instance, on the side of a hill. The Professor then, for the information of the younger students, explained, by diagrams, the nature of slopes, and the meaning of the expression "two feet to one," &c., and concluded by recommending that, in forming slopes, the engineer should run some risk of slips, in order to save the great expense of removing more earth than is actually necessary—the cost of repairing these slips being but little in comparison. He likened the work to an insurance on life, the risk to be run being calculated upon by precedents. The principle is to get the greatest extent of work finished at the least possible expense, and many of the great slips that have taken place might have been prevented, or speedily cured, had the plans he laid down been better followed.

Lecture VI.—Wednesday, December 29th, 1841.—Professor Vignoles stated that before continuing the subject of earthworks, he wished to set right an erroneous impression with the public, in consequence of an expression he made use of at his last lecture; he had then recommended that "the engineer should run some risk of slips, in order to save the great expense of removing more earth than was actually necessary—the cost of repairing these slips being but trifling in comparison." He need not say that he so expressed himself, but

it was always on the supposition that no risk was to be run where there was the remotest probability of danger. He mentioned this because of the circumstance of the slip on the Great Western Railway, which was attended with such fatal results, and happening only a few hours after he had made that statement. From all that had been stated, it appeared that the slip itself was but very inconsiderable; the cutting where it took place was 57 feet deep, the slope two to one, and the width of the road 40 feet; the slip took place about half way up the bank. A number of smaller slips had occurred, and tiles were used for draining, instead of bushes, &c., to cure them—still the mode of curing them was the same as he advocated—by drainage. As he had before stated, the slip itself was very inconsiderable, but, by having nothing to check it, the earth fell upon the rails. A doubt seemed to exist whether the concussion produced in the air by the passing of the former train, had not brought it down, for the accident happened in the interval between the passing of the two trains—the first one having proceeded uninjured, whilst the latter was attended with such fatal consequences. If the precaution had been taken, when it was first observed that a slip was likely to occur, to put up a fence of hurdles to check its advance to the rails, doubtless, the accident would not have happened. The manner of the slip showed that it was caused solely by the infiltration of water, probably a considerable way back from the edge of the cutting, or, perhaps the water had found its way in by the ditch along the top; the water which had thus got into the soil having expanded during the frost, the sudden change of the weather brought down the earth. The Professor then, by means of a diagram, explained the nature of the cutting, from which it appeared that the "top lift" was deposited in spoil bank. At the top of the cutting, a drain had also been cut, but he was of opinion that such drains were injurious, when the soil was at all precarious. The spoil bank was not the occasion of the slip, since it did not take place at the top, but bulged out in the middle. Although this slip was very small, from the fatal effects which attended it, it was the more necessary to guard against the recurrence of the like. There were but a few feet of earth on the rails, yet the effect was the same as if so many planks had been placed upon them. The Croydon slip arose from the same cause, but, though so much larger, no accident occurred. In the late accident there were but thirty or forty wagon loads of earth, and all was right again in a few hours, while in the Croydon slip 3,000 or 4,000 cubic yards of earth fell; the soil in both instances consisted of the London clay, with pot-holes of sand. It was clear that the accident was not to be set down as one of cutting, similar slips having taken place upon cuttings not more than twelve or fourteen feet deep. He must impress upon the minds of the students that it was not the length or depth of the cuttings which regulated the slopes, but the soil and practicability of drainage; unfortunately it was impossible to know exactly how these matters might stand—experience alone could teach them. He had dwelt long upon this subject, but he wished it to be understood that it was well-judged economy he advocated, not such as would, in the

least degree, tend to produce such fatal effects as in the case previously alluded to.

The balancing of the line was equally necessary for railroads as for canals or common roads; it should be the engineer's aim that the quantity of the earth from the cuttings should be as near as possible sufficient for the embankments; compared with former times, the mode of transit was so much facilitated, that where some years back it was necessary that the balance line should be limited to the hill to be cut through, and the valley to be filled up, now the line might extend two or three miles. It was essential in balancing that the engineer should be aware of the different degrees of compressibility of the matter; it was known of sand that it would occupy the same cubic contents in the embankment as it did in the hill, and one yard or 100 yards of gravel would be still the same; but in clays it was very different, they occupying less space in the embankment than they did in the hill, in their original position; 100 yards of clay would not make 100 yards of embankment, the average amount of compressibility being not less than ten per cent., or even, upon occasions, as much as 15 per cent. He had known occasions when 100 yards cut from a hill had only made 85 yards of embankment, but, upon an average, it would require 110 yards of clay to make 100 yards of embankment. Rock cuttings, on the contrary, expanded, because the solid rock could never again be restored to the same degree of density; the difference would vary much, according to the size of the fragments; but where the pieces were large, 100 yards would make 120 yards of embankment.* Chalk, again, would be rather upon the excess, though much depended upon its quality. In rock cuttings you might make them nearly perpendicular, but in chalk much discussion† has arisen as to what was the proper slope, some engineers having even recommended that it should overhang the road; but he contended that it should slope, to carry off the water. He had found a slope of one quarter to one generally sufficient. Rock chalk would stand perpendicular, while several of the softer descriptions would require a slope of one half to one, or even two to one.

The Professor then proceeded to speak of the correct mode of computing the quantity of earth in a cutting or embankment, and made a section of a hill half a mile long, to be cut down, the true cubic contents of a portion of which was 332,000 cubic yards, computed according to the prismoidal formula; but the ordinary method by which contractors would calculate the contents of the hill, by mean heights, would only show 310,000 cubic yards—that is to say, there would be a difference of 22,000 cubic yards against the contractor, the consequence of which had been, that the person contracting to cut down such a hill, at so much per yard, would lose, from his bad method of calculation, above £1,000. Another method was also in use—calculating by the mean area; which system, instead of 332,000 cubic yards, would show 376,000 cubic yards—being an excess in

* These remarks strongly corroborate those of an American engineer, inserted in th Journal of December last.—[Ed. C. E. & A. Jour.

† See the evidence on the Brighton Railway before the House of Lords.

favor of the contractor of 44,000 cubic yards. Many contractors had realized large fortunes by mean areas, and sustained serious losses by mean heights. Having thus shown the erroneous methods of calculation in use, he then, at some length, explained the prismoidal formula, accompanying his instructions with many diagrams, without which, any attempt at explanation on our part would be useless. The learned Professor concluded his lecture by strongly recommending a close study of mathematics to the junior (all) students, as the greatest assistant to the labours of the civil engineer.

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(To be continued.)

Wooden Pavements.

In some of the English periodicals, lately received at the Institute, we notice statements to the effect, that pavements of wood are generally approved in England, are rapidly extending in London, and that even the Thames Tunnel *is to be paved with wood.*

From all this, we are induced to believe that some superior mode of laying and preserving these pavements has been adopted in England, which is yet unknown amongst us.

For here in the United States, *wooden pavements are regarded now as a decided failure*, so much so, indeed, that considerable surfaces of them are now about to be removed, both in New York and in this city, and replaced, partly, by cubical blocks of granite, and partly, by the ancient water-worn pebble stones, so long used in the American cities.

We should, therefore, feel indebted to our scientific cotemporaries on the other side of the water, if any of them would furnish for our information, through the columns of their valuable periodicals, a statement

I. Of the original cost, in London, of the finished wooden pavement per square yard.

II. Of the durability and annual repairs of the same.

III. Of the most approved mode of cutting and preparing the wooden blocks, forming the foundations, and laying the pavement ready for travel.

The great objection here urged against wooden pavements, is their *very rapid decay*, and the unpleasant nature of the traveling over them, as soon as they begin *to rot in holes;* which we find to take place, with those which have been here laid with hemlock timber, in the very short space of *about four years.* M.

Bibliographical Notice.

"*A descriptive and historical account of Hydraulic, and other, Machines for raising water, ancient and modern: with observations on various subjects connected with the Mechanic Arts, including the progressive development of the Steam Engine. Description of every variety of Bellows, Piston, and Rotary Pumps, —Fire Engines—Water Rams—Pressure Engines—Air Machines—Eolipiles, &c. Remarks on Ancient Wells—Air Beds—Cog Wheels—Blow Pipes—Bellows of various people—Magic Goblets—Steam Idols, and other machinery of ancient Temples. To which are added experiments on blowing and spouting tubes, and other original devices. Nature's modes and machinery for raising water. Historical notices respecting Siphons, Fountains, Water Organs, Clepsydræ, Pipes, Valves, Cocks, &c. In five books, illustrated by nearly three hundred engravings. By Thomas Ewbank.* New York, D. Appleton & Co., 8vo., pp. 582."

We have given the entire title of the work we are about to notice, deeming this necessary in order to convey a proper idea of its contents. The general object of its author is to furnish the history of the origin and progress of the various machines which have been invented and used for the raising of water; and the five books into which the volume is divided, treat, 1st. On primitive and ancient devices for raising water. 2nd. On machines for raising water by the pressure of the atmosphere. 3rd. On machines for raising water by compressure, independent of atmospheric influence. 4th. On machines for raising water, (chiefly of modern origin,) including early applications of steam for that purpose. 5th. Novel devices for raising water, with an account of siphons, cocks, valves, clepsydræ, &c., &c. To these five books is added an appendix, containing miscellaneous items on various matters related to the general subject.

We have long known that Mr. Ewbank was preparing this work for the press, and have looked for its publication with a conviction that we should derive much valuable information from its perusal; an expectation that has been fully justified by the result. It is not our design to give a regular review of this work; indeed, this would be hardly possible, as it is itself a review of the origin and progress of hydraulic machinery, and does not pretend to give a minute description of the individual machines to which it refers. Those who are acquainted with that very interesting work, "Beckman's History of Inventions," will form a pretty correct idea of the nature of the present work, when we say that there is much similarity in the general character of the two; the main difference being that Beckman treats brief-

ly of the origin of inventions in general, relating to the useful arts, whilst Mr. Ewbank has limited his inquiries to a single, but comprehensive, class, with some of its genera, species, and varieties. The object of Beckman did not require the aid of the engraver, his subject being the origin of the arts, and not a description of any particular machines; whilst without the numerous illustrations given in the cuts in Mr. Ewbank's work, it would have been one of little value. There is in this respect, as well as in some others, a considerable resemblance between the book before us and Stewart's Anecdotes of the Steam Engine.

The reader of Mr. Ewbank's work will be disappointed should he expect to acquire from it a knowledge of the greater number of individual devices which have been introduced as improvements in hydraulic machinery; if he wishes to learn how the different kinds of pumps, or of valves, are constructed, he must, to acquire this knowledge, study other works; but if their history, from their rude beginnings to the state in which we now find them, is a matter of interest to him, he will find more in this work to gratify his curiosity respecting these, and numerous other inventions, than in any other which we could name.

We have said that Mr. Ewbank's book has been long in preparation for the press, and the evidence of this appears on almost every page; the authorities cited manifest unwearied, and very extended, research in books but little read, and difficult to obtain; and the manner in which the materials thus accumulated have been employed, reflects a very high degree of credit upon the author; whose life has not been that of a book-worm, but of a mechanic busily engaged in the working of metals; and who having by persevering industry acquired enough to render him independent of the melting-pot and the draw-bench, has been with equal diligence devoting himself to literature, in a department for which he had been fitted by his previous pursuits in business, and his habits of careful inquiry and observation. His work is not one which can fall still-born from the press, as it is not one of those ephemeral productions that must sell at the moment, or never; it is not an account of individual machines of recent invention, which are doomed to be superseded by the improvements of to-morrow; its historical details will be as useful, and the remarks upon them as interesting, half a century hence as they are at the present day.

From the nature of the work, it is miscellaneous in its character, and the materials which enter into its composition, might, undoubtedly, have been disposed in somewhat better order; but the former part, we are told, was stereotyped before the latter portions were written.

There are here, and there, some reflections and opinions relating to the political organization of society, which, however true in themselves, might have been advantageously omitted, as they are not only foreign to the subject of the work, but are, in some cases, calculated to offend; this we consider as a blemish, which is not fully redeemed by the many well conceived and happily expressed observations that render the book, as a whole, highly creditable to its author, who has himself anticipated the foregoing objection.

We have not made any extracts from the work, because it is our intention, at an early day, to republish some entire articles from it, which will exhibit its character more perfectly than could be done in the space allotted to this notice.

Notice of the United States Almanac, for 1843. *By* S. C. Walker.

We have been favored with the inspection of the printed sheets of a forthcoming work, by John Downes, entitled "The United States Almanac, for 1843."

Mr. Downes is favorably known to our readers, by his announcement of the lunar occultations of the fixed stars, which appeared in this Journal in 1841; these were interrupted by his engagements in the North Eastern Boundary Exploration, under Maj. Graham. As the Boundary question is now settled, we may indulge in a hope that these useful announcements will soon be resumed. The astronomical and engineering department of this work contains about one hundred pages of close print, embracing a complete calender, suited to any part of North America, from 10° to 50° North. The columns of the times of rising and setting of the sun and moon, and of high and low tides, are of sufficient compass for all this region. To the practical astronomer the work commends itself, by the general discussions of the Solar Eclipse of June 27th, 1843, which is visible in part of Louisiana, in Mexico, Texas, West Indies, and South America; also by the table of selected occultations, visible in North America, of stars, down to the seventh magnitude, inclusive. In preparing it, reference must have been made to the original star catalogues, as there is no general list of this kind published in Europe below the sixth magnitude. A list like this serves to form the basis for computing such special series for Philadelphia as have hitherto appeared, and will we hope again appear, in the Journal. The particulars respecting the planets and asteroids, are given with sufficient minuteness for the amateur, though not, perhaps, for the practical astronomer. Quite different is the case with the Ephemeris of the sun and stars, which are taken from the Nautical Almanac, and are reprinted in full. This dependency of American savans upon Europeans, must continue so

long as the country is destitute of the establishment of a nautical almanac of its own. The computations required exceed the means of any individual. The Lunar Ephemeris is of course only popular. Enough is given for the amateur. The practical navigator and astronomer must still resort to the British Nautical Almanac, or Blunt's reprint of the same, which alone would exceed the entire space here devoted to the calander and accompaniments. Mr. Downes has appended several useful tables for engineers; his tables for finding latitude and time by equal altitudes, for reduction to the meridian, for refractions, for measure of heights by the barometer, are all of the most approved construction, and such as a person engaged in field labor must find indispensable. The want of such tables in a portable form must, doubtless, have been felt by Mr. Downes, in the Boundary survey. The table for computing the heights of mountains by barometric observations, is taken from Bessel's paper in Schumacher's Astronomical Notices, vol. xv, Nos. 356 and 357, or rather from a reprint of the same, in a more popular form, in Schumacher's Jahrbuch, for 1840. Bessel's tables for computing heights by the barometer, have an important advantage over all the others that preceded them, in taking into account the degree of saturation of the atmosphere with vapor, or, in other words, the temperature of the dew point. The tables in use previous to Bessel's, were usually founded on Laplace's formulæ in the Mécanique Céleste. The simplest arrangement of the computation was contrived by Gauss, and has been reprinted by Baily in his "Astronomical Tables and Formulæ." These suppose a mean state of the atmosphere in respect to moisture, but make no allowance for the actual degree of saturation. Bessel's tables, when the mean condition of the atmosphere is supposed, agree very well with those of Gauss; but they go farther, and enable us to point out the correction required in the computed heights of stations for a rise or fall of the temperature of the dew point. As this subject is new to most of the readers of the Journal, we subjoin the following table, computed by Bessel, for the purpose of showing the maximum error which may arise from overlooking altogether the correction for the moisture of the atmosphere, or, in other words, the supposition of complete dryness.

An inspection of this table is sufficient to show the necessity of attending to this correction—for example, when the half sum of the temperatures is 68 °, and the difference of altitude 10,000 feet, the maximum effect of a saturation with vapor on the result is 105 feet. The mean ordinarily used is 52.5 feet, which is the greatest error that can be committed in this case, by supposing the atmosphere to be in a mean state of moisture.

We have been led into this digression by the consideration of the importance of this element in the discussion of the meteorological registers recently published in this Journal.

Difference of Altitude in Toises.	Half Sum of the Temperatures of the Air, in Degrees of the Centigrade Thermometer.		
	0°	10°	20°
T.	T.	T.	T.
500	1.36	2.55	4.64
1000	2.90	5.41	9.83
1500	4.62	8.61	15.60
2000	6.55	2.18	22.02
2500	8.70	16.15	29.14
3000	11.10	20.55	37.02
Difference of Altitude in English feet.	**The same for Fahrenheit.**		
	32°	50°	68°
Feet.	Feet.	Feet.	Feet.
3197.3	8.70	16.31	29.67
6394.6	18.55	34.60	62.85
9593.2	29.54	55.06	99.76
12789.2	41.89	77,89	140.81
15986.5	55.64	103.27	186.33
19183.8	70.98	131.40	236.72

On the whole, we must conclude that the Ephemeris is the most complete manual for the surveyor, topographical engineer, and practical astronomer, that has yet appeared in this country, in a form suitable for the pocket.

The geographical and statistical part of the work fills the remaining two hundred pages, and gives a list of the principal cities, ports, naval and military stations, with their appropriate latitudes and longitudes, from the best and most recent authorities. Then follows the herculean work of a digest of the census of 1840; this has been effected from the general table of statistics published in folio by Congress, so as to give, under an alphabetical arrangement, every town, county, territory, and state, in the Union, that has a local habitation and a name, with their respective populations, according to this census. The work contains, also, an epitome of the *blue* book, and will be of great use to office-holders and expectants of office, under the federal, state, or municipal governments. Every post-officer whose salary exceeds $500 is mentioned, and the location of his post-office is given. Full information is furnished respecting foreign and home diplomatic agents, the principal officers of the army and navy list, the executive cabinets, the auditors, collectors, consuls, &c., and their salaries. The work also contains full tables relative to the commerce,

imports, and exports of the country, during the several presidential terms; the aggregate value, produce, capital invested, and persons employed, in every department of commerce, and manufactures, and produce of the country. These tables contain highly useful information; they have been compiled from the census returns made by the marshals of the several districts in the United States. Another important item—that of the state debts—is stated at full, with the date when, and purposes for which, they were contracted; the causes of the unprofitableness of the public works of some of the states, and of their success in others. The work also contains an estimate of the rate of increase of the population of the United States for every ten years, since 1790, with estimates for 1850, '60, and '70; thus it appears that the average ten year increase has been $34\frac{15}{100}$ per cent—at which rate the population would amount, in 1870, to about forty-one millions.

As the subject is one of great importance, and as it may be desirable to know the amount of our population at intermediate periods between the censuses, we have endeavored to deduce from a discussion of the six censuses from 1790 to 1840, inclusive, the most plausible analytical expression of this population, any year. The method employed consists in considering these six censuses as six terms of a series, of which the generating function is required.

Let P_n = the population of the United States at any date n.
P_m = the same at any other date m.
r_n = the rate of increase of the population for the year whose middle has the date n.

Then if we suppose r to vary according to the powers of the intervals in years $(m—n)$, we have between P_n and P_m the following equation:

$$(1) \cdots P_n = P_m \left(r_n + A \cdot (m-n) + B \cdot (m-n)^2 + C \cdot (m-n)^3 + \&c. \right)^{(m-n)}$$

or,

$$(2) \cdots \left(\frac{P_n}{P_m} \right)^{\frac{1}{m-n}} = r_n + A \cdot (m-n) + B \cdot (m-n)^2 + C \cdot (m-n)^3 + \&c.$$

in which, A, B, C, &c., are the unknown constant co-efficients of the successive powers of the interval $(m—n.)$ Giving to n the value of 1840, and to m the successive dates of the first five censuses, which we take from the table given by Mr. Downes, and which is reported below, and neglecting the third and higher powers of the interval $(m—n)$, on account of the smallness of the number of censuses, or terms of the series, we find, by means of the last formula,

$$\text{for } m = 1790;\ r_{1840} - 50\,A - 2500\,B = 1.0298086$$
$$= 1800;\ r_{1840} - 40\,A - 1600\,B = 1.0296412$$
$$(3) \quad = 1810;\ r_{1840} - 30\,A - 900\,B = 1.0290009$$
$$= 1820;\ r_{1840} - 20\,A - 400\,B = 1.0289878$$
$$= 1830;\ r_{1840} - 10\,A - 100\,B = 1.0286688$$

Whence

$$v_0 = A + 90\,B + 1674\,.\,(10)^{-6}$$
$$v_1 = A + 70\,B + 6403\,.\,(10)^{-6}$$
$$v_2 = A + 50\,B + 131\,.\,(10)^{-5}$$
$$v_3 = A + 30\,B + 3190\,.\,(10)^{-5}$$

And by least squares

$$A = -7641\,.\,(10)^{-9} + 0.6722 \times \eta - 0.0098 \times \xi$$
$$B = -316\,.\,(10)^{-9} + 0.0000 \times \eta - 0.0098 \times \xi$$

These in No. (3) give

$$(r_n)_0 = 1.0286365$$
$$(r_n)_1 = 1.0288300$$
$$(r_n)_2 = 1.0284873$$
$$(r_n)_3 = 1.0287086$$
$$(r_n)_4 = 1.0285608$$
$$\text{Mean } r_n = 1.02864464 = r_{1840}$$

These values of r_n, A, and B, in No. (1), give for the population of the United States for any year denoted by m, the value of $P_m =$

$$17{,}068{,}666.\left[1.02864464 + 7641.(10)^{-9}.(1840-m) + 316.(10)^{-9}.(1840-m)^2\right]^{(m-1840)}$$

The following table contains the population of the United States for the decades from 1750 to 1900, inclusive, as derived from this formula, compared with the actual census. A formula which, reckoning backwards from 1840 to 1790, represents the population of the United States, with a maximum error of 38,000, and with a sum of errors of 95,000, in an aggregate of 56,000,000, must afford a plausible estimate for two or three censuses to come. It is impossible by the censuses before and since 1800, and 1810, to interpolate the values of the two latter. Can it be that the disturbed state of Europe and the West Indies, from 1790 to 1800, caused an excess of immigration to the United States of about 40,000, of which the greater part returned, under the more settled and consolidated governments from 1800 to 1810? Can any portion of the emigration, or falling off of the immigration in the latter period, be attributed to the restrictions upon commerce incident to the state of the times and to our domestic policy? We leave the subject to the decision of political economists.

Date.	POPULATION OF THE UNITED STATES.		
	By Census.	By Formula.	Discrepancy.
1750		1,015,000	
1760		1,455,000	
1770		2,054,000	
1780		2,859,000	
1790	3,929,827	3,928,000	— 2,000
1800	5,305,940	5,344,000	+ 38,000
1810	7,239,814	7,207,000	— 33,000
1820	9,638,191	9,650,000	+ 12,000
1830	12,866,020	12,856,000	+ 10,000
1840	17,068,666	17,068,666	0.000
1850		22,629,000	
1860		30,007,000	
1870		39,890,000	
1880		53,200,000	
1890		71,000,000	
1900		97,000,000	

Physical Science.

On the Chemical Statics of Organized Beings. *By* M. Dumas.

[CONTINUED FROM PAGE 92.]

III. Let a seed be thrown into the earth, and be left to germinate and develope itself; let the new plant be watched until it has borne flowers and seeds in its turn, and we shall see, by suitable analyses, that the primitive seed, in producing the new being, has fixed carbon, hydrogen, oxygen, azote, and ashes.

Carbon.—The carbon originates essentially in carbonic acid, whether it be borrowed from the carbonic acid of the air, or proceed from that other portion of carbonic acid which the spontaneous decomposition of manures continually gives out in contact with the roots.

But it is from the air especially that plants most frequently derive their carbon. How could it be otherwise, when we see the enormous quantity of carbon which aged trees, for example, have appropriated to themselves, and yet the very limited space within which their roots can extend? Certainly, when a hundred years ago the acorn germinated, which has produced the oak that we now admire, the soil on which it fell did not contain the millionth part of the carbon that the oak itself now contains. It is the carbonic acid of the air which has supplied the rest, that is to say, nearly the whole.

But what can be clearer and more conclusive than the experiment of M. Boussingault, in which peas, sown in sand, watered with distilled water, and having no aliment but air, have found in that air all the carbon necessary for development, flowering, and fructification?

All plants fix carbon, all borrow it from carbonic acid; whether this be taken directly from the air by the leaves, whether the roots imbibe within the ground the rain water impregnated with carbonic acid, or whether the manures, whilst decomposing in the soil, supply carbonic acid, which the roots also take possession of to transmit it to the leaves.

All these results may be proved without difficulty. M. Boussingault observed that vine leaves which were enclosed in a globe took all the carbonic acid from the air directed across the vessel, however rapid the current. M. Boucherie also observed enormous quantities of carbonic acid escape from the divided trunk of trees in full sap, evidently drawn by the roots from the soil.

But if the roots imbibe this carbonic acid within the earth, if this passes into the stalk and thence into the leaves, it ends by being exhaled into the atmosphere, without alteration, when no new force intervenes.

Such is the case with plants vegetating in the shade or at night. The carbonic acid of the earth filters through their tissues, and diffuses itself into the air. We say that plants produce carbonic acid during the night; we should say, in such a case, that plants transmit the carbonic acid borrowed from the soil.

But let this carbonic acid, proceeding from the soil or taken from the atmosphere, come into contact with the leaves or the green parts, and let the solar light, moreover, intervene, then the scene all at once changes.

The carbonic acid disappears; bubbles of free oxygen arise on all the parts of the leaf, and the carbon fixes itself in the tissues of the plant.

It is a circumstance well worthy of interest, that these green parts of plants, the only ones which up to this time manifest this admirable phenomenon of the decomposition of carbonic acid, are also endowed with another property not less peculiar, or less mysterious.

In fact, if their image were to be transferred into the apparatus of M. Daguerre, these green parts are not found to be reproduced there: as if all the chemical rays, essential to the Daguerrian phenomena, had disappeared in the leaf, absorbed and retained by it.

The chemical rays of light disappear, therefore, entirely in the green parts of plants; an extraordinary absorption, doubtless, but which explains, without difficulty, the enormous expense of chemical force necessary for the decomposition of a body so stable as carbonic acid.

What, moreover, is the function of this fixed carbon in the plant? for what is it destined? For the greater part, without doubt, it combines with water or with its elements, thus giving birth to matters of the highest importance for the vegetable.

If twelve molecules of carbonic acid are decomposed and abandon their oxygen, the result will be twelve molecules of carbon; which, with ten molecules of water, may constitute either the cellular tissue of plants, or their ligneous tissue, or the starch and the dextrine which are produced from them.

Thus, in any plant whatever, nearly the entire mass of the structure, (charpente,) formed as it is of cellular tissue, of ligneous tissue, of starch, or of gummy matters, will be represented by twelve molecules of carbon united to ten molecules of water.

The ligneous part which is insoluble in water, the starch, which gelatinises (l'amidon, qui fait empois) in boiling water, and the dextrine which dissolves so easily in water cold or hot, constitute, therefore, as M. Payen has so well proved, three bodies possessing exactly the same composition, but diversified by a different molecular arrangement.

Thus, with the same elements, in the same proportions, vegetable nature produces the insoluble walls of the cells of cellular tissue and of the vessels, or the starch which she accumulates as nourishment around buds and embryos, or the soluble dextrine which the sap can convey from one place to another for the wants of the plant.

How admirable is this fecundity, which out of the same body can make three different ones, and which allows of their being changed one into the other, with the slightest expense of force, every time occasion requires it!

It is also by means of carbon united with water, that the saccharine matters so frequently deposited in the organs of plants for peculiar purposes, which we shall shortly mention, are produced. Twelve molecules of carbon and eleven molecules of water form the cane sugar. Twelve molecules of carbon and fifteen molecules of water make the sugar of the grape.

These ligneous, amylaceous, gummy, and saccharine matters, which carbon, taken in its nascent state, can produce by uniting with water, play so large a part in the life of plants, that, when they are taken into consideration, it is no longer difficult to understand the important part that the decomposition of carbonic acid performs in plants.

Hydrogen.—In the same manner that plants decompose carbonic acid for the appropriation of its carbon, and in order to form together with it all the neutral bodies which compose nearly their entire mass; in the same way, and for certain products which they form in less abundance, plants decompose water and fix its hydrogen. This appears clearly from M. Boussingault's experiments on the vegetation of peas in closed vessels. It is still more evident from the production of fat or volatile oils so frequent in certain parts of plants, and always so rich in hydrogen. This can only come from water, for the plant receives no other hydrogenated product than the water itself.

These hydrogenated bodies, to which the fixation of the hydrogen borrowed from the water gives birth, are employed by plants for accessory uses. They form, indeed, the volatile oils which serve for defence against the ravages of insects; fat oils or fats, which surround the seed, and which serve to develope heat by oxidation (en se brûlent) at the moment of germination; waxes with which leaves and fruits are covered so as to become impermeable to water.

But all these uses constitute some accidents only in the life of plants; thus the hydrogenated products are much less necessary, much less

common, in the vegetable kingdom, than the neutral products formed of carbon and water.

Azote.—During its life, every plant fixes azote, whether it borrows the azote from the atmosphere, or takes it from the manure. In either case it is probable that the azote enters the plant, and acts its part there only under the form of ammonia or of nitric acid.

M. Boussingault's experiments have proved that certain plants, such as Jerusalem artichokes, borrow a great quantity of azote from the air; that others, such as wheat, are, on the contrary, obliged to derive all theirs from manure: a valuable distinction for agriculture; for it is evident that all cultivation should begin by producing vegetables which assimilate azote from air, to rear by their aid the cattle which will furnish manure, and employ this latter for the cultivation of certain plants which can take azote from the manures only.

One of the most interesting problems of agriculture consists, then, in the art of procuring azote at a cheap rate. As for carbon, no trouble need be taken about it; nature has provided for it; the air and rain water suffice for it; but the azote of the air, that which the water dissolves and brings with it, the ammoniacal salts which rain water itself contains, are not always sufficient. With regard to most plants the cultivation of which is important, their roots should also be surrounded with azotated manure, a permanent source of ammonia or of nitric acid, which the plant appropriates as they are produced. This, as we know, is one of the great expenses of agriculture, one of its great obstacles, for it possesses only the manure which is of its own production. But chemistry is so far advanced in this respect, that the problem of the production of a purely chemical azotated manure cannot be long in being resolved.

M. Schattenman, the skilful director of the manufactories of Bouxvilliers in Alsace, M. Boussingault, and M. Liebig have turned their attention to the functions of ammonia in azotated manures. Recent trials show that the nitric acid of the nitrates also merit particular attention.

But for what purpose is this azote, of which plants seem to have such an imperious want? M. Payen's researches partly teach us; for they have proved that all the organs of the plant, without exception, begin by being formed of an azotated matter analogous to fibrine, with which at a later period are associated the cellular tissue, the ligneous tissue, and the amylaceous tissue itself. This azotated matter, the real origin of all the parts of the plant, is never destroyed; it is always to be found, however abundant may be the non-azotated matter which has been interposed between its particles.

This azote, fixed by plants, serves, therefore, to produce a concrete fibrinous substance, which constitutes the rudiment of all the organs of the vegetable.

It also serves to produce the liquid albumen which the coagulable juices of all plants contain; and the caseum, so often confounded with albumen, but so easy to recognise in many plants.

Fibrin, albumen, and caseum exist, then, in plants. These three products, identical in their composition, as M. Vogel has long since

proved, offer a singular analogy with the ligneous matters, the amidon, and the dextrine.

Indeed, fibrin is, like ligneous matter, insoluble; albumen, like starch, coagulates by heat; caseum, like dextrine, is soluble.

These azotated matters, moreover, are neutral, as well as the three parallel non-azotated matters; and we shall see that by their abundance in the animal kingdom they act the same part that these latter exhibited to us in the vegetable kingdom.

Besides, in like manner as it suffices for the formation of non-azotated neutral matters, to unite carbon with water or with its elements, so, also, for the formation of these azotated neutral matters, it suffices to unite carbon and ammonium with the elements of water; forty-eight molecules of carbon, six of ammonium, and seventeen of water, constitute, or may constitute, fibrin, albumen, and caseum.

Thus, in both cases, reduced bodies, carbon or ammonium, and water, suffice for the formation of the matters which we are considering, and their production enters quite naturally into the circle of reactions, which vegetable nature seems especially adapted to produce.

The function of azote in plants is therefore worthy of the most serious attention, since it is this which serves to form the fibrin which is found as the rudiment in all the organs; since it is this which serves for the production of the albumen and caseum, so largely diffused in so many plants, and which animals assimilate or modify according to the exigencies of their own nature.

It is in plants, then, that the true laboratory of organic chemistry resides. Thus, carbon, hydrogen, ammonium, and water are the principles which plants elaborate: ligneous matter, starch, gums, and sugars on the one part, fibrin, albumen, caseum, and gluten on the other, are, then, the fundamental products of the two kingdoms; products formed in plants, and in plants alone, and transferred by digestion into animals.

Ashes.—An immense quantity of water passes through the vegetable during the period of its existence. This water evaporates at the surface of the leaves, and necessarily leaves, as residue, in the plant the salts which it contained in solution. These salts compose the ashes, products evidently borrowed from the earth, to which, after their death, vegetables give it back again.

As to the form in which these mineral products deposit themselves in the vegetable tissue, nothing can be more variable. We may remark, however, that among the products of this nature, one of the most frequent and most abundant is that pectinate of lime discovered by M. Jacquelain in the ligneous tissue of most plants.

IV. If, in the dark, plants act as simple filters which water and gases pass through; if, under the influence of solar light, they act as reducing apparatus which decompose water, carbonic acid, and oxide of ammonium, there are certain epochs and certain organs in which the plant assumes another, and altogether opposite, part.

Thus, if an embryo is to be made to germinate, a bud to be unfolded, a flower to be fecundated, the plant which absorbed the solar heat, which decomposed carbonic acid and water, all at once changes its

course. It burns carbon and hydrogen; it produces heat; that is to say, it takes to itself the principal characters of animal life.

But here a remarkable circumstance reveals itself. If barley or wheat is made to germinate, much heat, carbonic acid and water are produced. The starch of these grains first changes into gum, then into sugar, then it disappears in producing carbonic acid, which the germ is to assimilate. Does a potato germinate, here, also, it is starch which changes into dextrine, then into sugar, and which at last produces carbonic acid and heat. Sugar, therefore, seems the agent by means of which plants develope heat as they need it.

How is it possible not to be struck from this with the coincidence of the following facts? Fecundation is always accompanied by heat. Flowers as they breathe produce carbonic acid: they therefore consume carbon; and if we ask whence this carbon comes, we see, in the sugar cane, for example, that the sugar accumulated in the stalk has entirely disappeared when the flowering and fructification are accomplished. In the beet root, the sugar continues increasing in the roots until it flowers; the seed-bearing beet contains no trace of sugar in its root. In the parsnip, the turnip, and the carrot, the same phenomena take place.

Thus, at certain epochs, in certain organs, the plant turns into an animal; it becomes, like it, an apparatus of combustion; it burns carbon and hydrogen; it gives out heat.

But, at these same periods, it destroys in abundance the saccharine matters which it had slowly accumulated and stored up. Sugar, or starch turned into sugar, are, then, the primary substances by means of which plants develope heat as required for the accomplishment of some of their functions.

And if we remark with what instinct animals, and men too, choose for their food just that part of the vegetable in which it has accumulated the sugar and starch which serve it to develope heat, is it not probable, that, in the animal economy, sugar and starch are also destined to act the same part, that is to say, to be burned for the purpose of developing the heat which accompanies the phenomenon of respiration?

To sum up, as long as the vegetable preserves its most habitual character, it draws from the sun heat, light, and chemical rays; from the air it receives carbon; from water it takes hydrogen; azote from the oxide of ammonium, and different salts from the earth. With these mineral or elementary substances, it composes the organised substances which accumulate in its tissues.

They are ternary substances, ligneous matter, starch, gums, and sugars.

They are quaternary substances, fibrin, albumen, caseum, and gluten.

So far, then, the vegetable is an unceasing producer; but if at times, if to satify certain wants, the vegetable becomes a consumer, it realises exactly the same phenomena which the animal will now set before us.

[TO BE CONTINUED.]

Description of an Electric Thermometer. *By* E. SOLLY, *Jun., Esq.*

I am induced to send the following account of a little thermo-electric arrangement, believing that it may be interesting; for although there is little or no novelty in the principles on which its action depends, I am not aware that it has been before practically employed.

I had for some time experienced considerable inconvenience in conducting certain experiments requiring a long-continued and uniform degree of heat, from the difficulty of regulating the temperature of my furnace, and the constant uncertainty whether everything was proceeding satisfactorily during my absence from the laboratory. I had, in consequence, often thought of the possibility of so arranging a little thermo-electric apparatus, that it might serve as an index of the rate of combustion and consequent heat of the furnace, by the deflection of a galvanometer at a distance from the source of heat. A small thermo-electric battery might be so placed that the one series of joints, or solderings, should be constantly exposed to the heated surface of the furnace; but a serious obstacle presented itself to any contrivance of this kind, which was, the difficulty of keeping the alternate joints of the battery cool. A current of electricity would doubtless be evolved, in consequence of the difference of temperature existing between the two sides of the battery; but, of course, as the heat would gradually traverse from the hotter to the cooler side, it would greatly diminish and modify the results, and thus present false indications of temperature—whilst even if it were possible to keep the one side of the battery cool, either by water or by any other means, yet the value of the deflection of the galvanometer would be always uncertain, as the difference between the two sides of the battery could never be ascertained unless the exact reduction of temperature thus caused were correctly known.

After one or two unsuccessful attemps to overcome this objection, I laid aside the battery, and substituted in its place a single pair of metallic elements, which I found gave abundance of power, and was not liable to the defect which the use of the battery involved.

A piece of copper wire, one-twenty-fourth of an inch in diameter, and of sufficient length to reach from the furnace to my ordinary sitting room, was joined by twisting the ends to a similar wire of soft iron—the ends of both having been previously well cleaned with sand paper. The two wires were then secured in a convenient manner, by small nails, to the walls of the rooms they had to pass through, care being taken that they were not anywhere in contact with each other, except at the two extreme points of junction; the one of these was so placed in the flue of the furnace that it was completely exposed to the action of the hot air and smoke at that part where the flue left the body of the furnace, whilst the other joint was in my room, in contact with a thermometer and surrounded with cotton, so as to render it as little as possible liable to sudden changes of temperature. The copper wire was then divided about a foot from the joint thus protected. The two ends of the wire were connected with the extremities of a galvanometer coil, and the apparatus was complete.

A metallic circuit was thus made, consisting of two elements—the one being the iron wire, and the other the copper wire, including the additional length of copper wire in the coil of the galvanometer. The one joint, or point of contact, was, of course, always far hotter than the other, and would necessarily remain so, so long as the fuel in the furnace continued to burn, and would be dependent on the rate of combustion in the furnace; whilst the other junction would always remain very nearly at the temperature of the air, and its variations could be readily known by the thermometer in contact with it. A current of electricity was thus generated, proportioned to the difference of temperature between the two joints, and a deflection of the galvanometer was caused, which increased when the furnace became hotter, decreased when it cooled, and at all times indicated accurately the changes of temperature taking place—thus giving me a thermometer which indicates, without my moving from the table, the exact rate of combustion going on in the furnace, which is fifty yards distant from the indicator. I believe that it is commonly supposed that weak thermo-electric currents cannot be well made to traverse small wires of any length, and this is probably the reason why this beautifully manageable power has been so little employed for practical uses. I have received so much satisfaction from the arrangement just described, that I am convinced it would be found a very useful indicator of temperature in stoves, flues, and hot pipes, in many situations where a common thermometer is inapplicable.

The cost of such an apparatus must necessarily be more expensive than any thermometer, but then it must be remembered that it does far more than an ordinary thermometer, giving us the means of knowing the temperature of a stove, or furnace, at a distance; giving us indications of the least change or variation in the source of heat, with even greater certainty and distinctness than a thermometer; and besides, showing these changes so rapidly, that we know whether it is becoming hotter or colder, before a thermometer, placed on the outside of the stove, indicates any change. I have observed, on comparing the thermo-electric with an ordinary thermometer, placed on the iron plate forming the top of the furnace, that if the ash-pit door were closed, or the draught in any other way diminished, the deflection of the galvanometer was immediately reduced, whilst the external thermometer continued to rise for some little time; and that the indications given by the galvanometer of the augmentation or decrease of temperature in the furnace, always preceded the same indications from the mercurial thermometer on the top.

London, October 20, 1841.

Lond. & Ed. Philos. Mag.

On the Mouths of Ammonites, and on other Fossils, found in the Oxford Clay, near Christian Malford, on the Line of the Great Western Railway. By Mr. C. Pearce.

The section exhibited at the point where Mr. Pearce obtained his specimens was as follows:

1. Alluvial soil, ... 2 feet.
2. Gravel, ... 8 "
3. Beds of laminated clay, alternating with layers of sandy clay, chiefly composed of broken shells, . 6 "

The fossils described in the paper were procured from No. 3, and consisted of crustaceans, which the author conceives inhabited the dead shells of the Ammonite, and to which he applies the generic name of Ammonicolax, of numerous bivalves and univalves, of Ammonites, with the mouths beautifully preserved, Belemnites, and an allied genus, for which he proposes the name of Belemnoteuthis. Of many of these fossils detailed specific characters are given, but as they do not admit of abridgement, we must confine our notice to the author's remarks on the structure of the mouth of the ammonite. Mr. Pearce is of opinion that the lip, or perfect termination, assumes a different shape in almost every species, and that it has a simpler form in the adult, or full grown shell, than in immature individuals. For several years he has remarked, that specimens of what he considered to be full grown ammonites, with a perfect lip, had a nearly straight, or slightly waved, margin, whilst smaller, and as he conceives younger, shells, of the same species, possessed, in many instances, lateral prolongations, equalling, occasionally, in length, as he has recently observed, five-sixths of the diameter of the fossil. During the growth of the shell these processes, he is of opinion, were successively absorbed and reproduced, but were never added to the final lip. From an extended examination of ammonites belonging to various rocks, Mr. Pearce infers, that in the young shell, provided with lateral projections, the animal filled not merely the whole of the last chamber, but extended beyond it, and thereby guarded the processes from injury, and received support, or protection, from them. On the contrary, the last chamber of the mature shell having been, he believes, sufficiently large to receive the whole of the soft parts of the animal, the lateral appendages were not required, and, consequently, were not added to the lip. In the course of the paper, some remarks were offered on other species of ammonites, which apparently never possessed lateral processes at any period of growth, but are characterized by contractions, or expansions, of the shell, at certain points; and in those cases, Mr. Pearce concludes that the additions were made without the absorption of the old mouths.—*Transactions Geolog. Soc.*

Athenæum.

Notice of the Occurrence of Fossil Plants in the Plastic Clay at Bournemouth, Hants. By the Rev. P. B. Brodie.

To the east of Bournemouth, the cliffs consist of white and yellow sands belonging to the plastic clay, and as they range along the shore they increase in height—beds of clay, full of vegetable remains, appearing under the sands. About half a mile from this point they are composed of alternations of white, grey, and yellow, sand, overlaid by strata of clay, divided by thin layers of vegetable matter. In a bed of white sand, near the middle of the cliff, are impressions of

ferns; and a layer of sandy clay is full of small leaves. Somewhat farther, are strata of sand and sandy clay, abounding with beautiful vegetable remains. The plants are frequently so well preserved that the epidermis peels off when the specimen is exposed, and they are stated, by the author, to belong to genera of a warmer climate than that which now prevails in Great Britain. Ibid.

Mechanics' Register.

LIST OF AMERICAN PATENTS WHICH ISSUED IN JULY, 1841.

With Remarks and Exemplifications by the Editor.

1. For an improvement in *Fire Engines;* Joseph B. Babcock, Marietta, Washington county, Ohio, July 1.

The cylinders and pistons, or plungers, are placed horizontally, and these cylinders, with the part of the apparatus to which they are attached, are secured down to the bottom of the cistern. The pistons, or plungers, are hollow, and are provided with valves for the admission of the water into the cylinders; they are attached to the ends of a square frame, inside, the side pieces of which are provided with racks, into which the teeth of two segment cog wheels work, said segments being attached to the brake.

Claim.—"What I claim is the manner in which I have constructed, arranged, and combined, two horizontal hollow pistons, with the horizontal cylinders affixed to the bottom of the cistern of a fire engine, and also with the vibrating frame and segment wheels; the whole being constructed and operating as set forth. I do not claim either of these parts separately and individually, but I do claim so to have combined them as to produce an instrument new in its construction, and useful in its operation."

2. For an improvement in the *Bee Hive;* John M. Weeks, Salisbury, Addison county, Vermont, July 1.

"What is claimed as constituting the invention, and not previously known in bee hives, is the mode of regulating the ventilation of the hive by means of tubes lined with wire gauze, and having apertures to which the adjustable caps, perforated with similar apertures, are adapted; the whole being constructed in the manner set forth. Also, combining with the central box, or line, one or more collateral boxes, containing smaller hives, in combination with the mode of ascertaining and regulating the temperature of the hives, by means of thermometrical and ventilating apparatus; the whole being constructed, and operating, substantially in the manner described."

3. For an improvement in the *Horse Power;* Thomas J. Wells, New York city, July 1.

This horse power is actuated by belts, instead of by cog wheels; the horse sweep turns on a centre pin, in the middle of a circular

platform, around which a band passes, that extends to, and around, a small wheel, the axle of which has its bearings near the outer extremity of the sweep. On the upper end of this axle there is a band wheel, from which a band extends to a small wheel, turning on the same pin with the horse sweep; connected to this small wheel, and turning with it, there is a large wheel, from which a band extends to any machine to be driven.

Claim.—"I do not claim as my invention the mere substitution of a band for cogged wheels, in the construction of a horse power; nor do I claim simply placing the double wheels on the horse sweep, or lever, to travel around the main, or stationary, wheel, as this has been heretofore done with cog wheels having the axis of the traveling wheels within the periphery of the main wheel, the cogs of which were put on the inner periphery thereof; but what I do claim as my invention, and desire to secure by letters patent, is placing the traveling wheels on the sweep without the periphery of the main, or stationary, wheel, in combination with the employment of bands, as herein described."

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4. For improvements in the *Steam Boiler and Evaporator;* Oran W. Seely, New York city, July 1.

This patent is obtained for an improvement on a steam boiler, or evaporator, patented to the said Seely, and Dudley Marvin, on the 28th of August, 1840, and noticed in this Journal, at page 264, vol. ii, 3rd series—by a reference to which notice, the nature of the improvement, as embraced in the following claim, will be readily understood.

Claim.—"What I claim, and desire to secure by letters patent, is, first, the manner of forming the stay bolts in the respective cells, by means of cores, sustained upon a grating of iron, constructed in the manner set forth; said cores having holes bored through them whereever stay bolts are required to cross the cells; the respective parts being arranged in the manner, and for the purpose, [to give sufficient strength to resist the force of high steam,] set forth. And, secondly, I claim the sustaining of the body of the boiler, by means of iron pieces, crossing from side to side, and bolted through the plates forming the upper part of the division between the cells, as above described. I also claim the use of such bridge pieces, in the same manner, and for the same purpose, whether the body of said boiler be formed of cast iron, in one entire piece, or of sheet metal, by riveting the same together in the ususl way."

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5. For an improvement in the *Canal Lock;* Robert English, Lagro, Wabash county, Indiana, July 1.

The patentee calls this "the air and water-acting sympathetic canal lock gate."

At the upper end of the lock, which is the subject of this patent, there is to be an air-tight chamber, provided with what the patentee calls "sympathetic gates, "which are hinged to the lock in such a manner as to shut one upon the other, the lowermost being provided with an air-tight float. Below these two gates there are two valves, one of

which communicates with the water in the upper chamber of the lock, and the other with a culvert leading to a lower level. When the first named valve is opened, the chamber below the gates is filled with water, which, acting on the float, forces up the gates, and thus closes the lock; and when this valve is closed, and that leading to the culvert opened, the water running out of the chamber to a lower level, leaves a partial vacuum below the gates, which are consequently forced down by the pressure of the atmosphere, aided by their own gravity; a communication is thus opened between the upper and lower levels. Where the water discharges from the upper to the lower level, there is a breakwater attached by hinges to the lock, to prevent the water from rushing too suddenly on to the boat in the lower lock.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the arrangement of the vertically moving gates and air-float, in combination with the chamber, trunks, or culverts, and valves, as a substitute for the common horizontally moving gates—said gates being opened and closed by the combined action of air and water, in the manner set forth, or any other substantially the same. I also claim, in combination with the foregoing, the self-acting breakwater, as described."

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6. For an improvement in the mode of *Fastening Scythes to Snaths;* Silas Lamson, Shelburn Falls, Berkshire county, Massachusetts, July 1.

The first item claimed is a mode of securing the blade to the snath, by means of a metallic saddle, fitted to the lower end of the snath, which saddle receives a shank at the heel of the blade, in combination with the mode of securing the two plates together, either by means of two cam bolts, which pass through slots in the saddle, and which, when turned, secure the shank, or by a spring-catch, which catches in a notch made for that purpose, in that part of the shank which passes through, and extends beyond, the saddle. The second item of the claim is to another mode of securing the blade to the snath, by slitting the heel end of the blade, and turning one part at right angles thereto, and "securing these portions to the snath by screws, one of which has a large flat head to lap over the blade and over the shank, which is placed in an oblong mortise in the turned-up end of the blade, to allow of its being regulated." The third item is also for securing the blade to the snath, by "rendering the heel end of the blade concave, to fit the convex end of the snath, and turning a portion over the back of the snath, and a portion at right angles against the front of it, and securing the blade by screw-bolts, placed in oblong slots, by which the blade can be set at pleasure, as described." The fourth item is for accomplishing the same end by simply passing the bolts, by which the whole is secured, through oblong slots in the heel of the blade, by which it is said that "the blade can be adjusted easily, without removing the screws from the snath, by simply loosening them, and adjusting the blade on the shanks by means of the oblong slots." The fifth item is for securing the nibs to the snath "by form-

ing the two ends of the bar which surrounds the snath into a shank, and perforating the same with oblong apertures, to admit wedges, or keys, which pass through the nib and said apertures, for drawing the snath home to the nib." The sixth item is for effecting the object named in the fifth section, by the combination of a square snath, a saddle at the end of the nib, which rests on one of the angles of the snath, and a bolt, which passes through the whole.

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7. For improvements in the combined *Cooking and Air-heating Stove;* Alex. F. Bean, Woodstock, Windsor county, Vermont, July 8.

The claim under this patent is so full, that it needs no additional explanation.

Claim.—"I claim the manner of constructing the swinging hearth, so that the two sections thereof may both be turned entirely back, under and behind the back plate of the stone, and so that each section of it shall have on it a plate, or piece, so formed that when in place, these two pieces will cover, and entirely close, the opening situated beneath and between the vertical grate bars, and leading into the fire chamber; by which device, when the vertical grate bars are also closed, the fire chamber will become that of a close stove, and must receive its supply of air from without the room, in the manner set forth. I claim the mode in which I have combined a tin reflector with my stove, by hinging the same, or causing it to work upon joint pins, in such manner as that it may be turned up, and will, in combination with the sunk hearth, entirely inclose the opening in front of the stove, and that when turned down it will pass beneath the sunk hearth, and be entirely out of the way. I claim the manner of constructing the vertical grate bars in front of the fire, so that they shall consist of flat plates, or slots, hung upon pivots, and be capable of being simultaneously and entirely closed by bringing them into the same plane with each other, in the manner set forth. I claim the placing of the hinged grated piece so that it may be turned up to inclose in part the space, when necessary, and thus to prevent the falling of coals from the fire chamber; and which grated piece may be turned down, so as to be received within the sunken hearth. I claim the constructing of the grate below the fire, and which supports the fuel in the fire chamber, so that it may be raised up and throw the fuel upon the dead plate below it, for the purpose of being covered, to preserve it in a state of ignition. I claim the manner of arranging the parts concerned in supplying air to the fuel, when the front of the stove is inclosed; said arrangement consisting of the tube, or pipe, the air tube, extending along the lower and hind part of the chamber of combustion, and the device by which it is governed at one end by a sliding shutter; the whole being combined and operating substantially as set forth. I claim the manner of constructing and combining the respective parts of the air-heating apparatus, as set forth; the said apparatus consisting mainly of two cylinders with a space between them, inclosing within them a spiral flue, for the passage of heated

air from the fire, through which flue pass a number of vertical air tubes, which are supplied with cold air from without the apparatus, as is also the space between the two inclosed cylinders—the same operating by an arrangement of parts such as is made known; there being in the centre of said air-heater a descending flue, for conducting the smoke, &c., to the exit pipe, and an arrangement, such as herein set forth, for allowing the heated air from the fire to pass directly to the exit pipe, without entering the spiral flue. I claim the manner of constructing the oven above the air-heater, as set forth, so that the heated air may be passed back and forth through it when baking is to be effected, or may be made to pass directly up into distribution tubes without entering the oven; this being effected by an arrangement of parts substantially as set forth."

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8. For an improvement in the Endless Chain *Horse Power*, for driving Machinery; William C. Wheeler and Alonzo Wheeler, Columbia, Chatham county, New York, July 8.

The lower edge of the links of the chains, which receive the boards that form the endless floor for the horse, or horses, to tread on, are provided with cogs that take into pinions on a shaft placed across the frame of the machine, to communicate motion to a thrashing, or other machine to be driven.

Claim.—"We are aware that endless chains for horse powers have been invented with plates joined together, and having cogs projecting from their under side, to act on a pinion, and, therefore, we do not claim this as our invention; but what we do claim, and desire to secure by letters patent, is providing the lower edge of the links of the chain, to which the endless flooring is attached, with cogs, to work into pinions, as described."

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9. For a machine for *Cutting Dovetails and Tenons;* Thomas J. Wells, city of New York, July 8.

The construction of this machine exhibits much mechanical skill. The cutters are attached to the periphery of a wheel on the end of a mandrel, and the wood to be tenoned is put on to a second mandrel, parallel to the first, the two being made to turn in the same direction, and with equal velocities. If the tenon is to be of four sides, four cutters are so arranged as to divide the periphery of the cutter wheel into four equal parts; and if the tenon is to be cut on two sides only, then two cutters are employed, and placed opposite to each other. As the cutters revolve they gradually approach the axis of the second mandrel, on which the wood is placed, until they reach a line passing through the axis of the two mandrels, and then they gradually recede from it. Although by means of drawings and diagrams the action of this apparatus might be rendered perfectly clear, it would not be easily understood from mere verbal description, and we shall not therefore attempt it.

Claim.—"The invention claimed, and desired to be secured by let-

ters patent, is the before-described mode of cutting tenons, or dovetails, or other forms, by a similar, simultaneous, rotary motion of the circular plane, and substance on which the tenon, dovetail, or other form, is to be made; the cutting being performed on an increment tangential line to the circumference of the revolving circular plane, whilst the cut made forms the chord line of a segment, on the piece of the circular rail cut away by the revolving cutter.

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10. For an improvement in the *Smut Mill;* Charles D. Childs, York, Livingston county, New York, July 8.

The patentee observes that the "Nature of his invention consists in cleaning damp wheat by throwing a heavy blast of air, with an inclined curved fan, through a column of wheat passing through revolving spikes of cast iron, that all dust and smut may escape through a case, or cylinder, of cast iron rings, having annular openings."

On the same shaft that carries the spikes, mentioned above, a fan is attached below them, said fan consisting of two inclined wings which force a current of wind upwards through the grain as it descends, and blow the chaff out through inclined tubes, or pipes, attached to the case. Below the fan, and on the same shaft with it, is a scouring wheel, with teeth like those of a corn mill. The grain is fed in at the top, and passes down between the revolving spikes, around the fan, and then down to the scourers.

Claim.—"I do not claim the combination of a revolving fan and beaters with a perforated case, or cylinder, as set forth, the fan being arranged below the beaters; nor do I claim the combination of a hopper with a revolving and stationary runner, inclosed in a case, the hopper being arranged above the revolving runner. What I claim is combining those two arrangements, in the manner set forth, the perforated case containing the beaters and fan being placed above that containing the hopper and runners, arranged in the manner described; the revolving runner being placed on the same shaft with the fan and beaters, and the bottom of the case containing the latter provided with spouts for carrying off the dust, and apertures to admit air to the fan, all as set forth."

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11. For an improvement in the *Pump;* C. D. Van Allen, Petersburg, Dinwiddie county, Virginia, July 8.

That part of the pump in which the piston works is made of iron, and the main body of wood, the sections being connected together by screws cut, or cast, on the ends of the iron part, and screwing into the wood; or, by having a metal socket screwed into the wood, and adapted to receive the male screw on the end of the iron section. The lower valve seat is flat, as is also the face of the valve, which is covered with a disk, or ring, of leather; and instead of being hinged in the usual way, it works up and down, in the manner of a puppet valve, guide pieces, or rods, which project from its lower side, serving to direct it properly.

Claim.—"What I claim as constituting my invention, and desire to secure by letters patent, is the combining and connecting together of the wooden and metallic parts thereof, by means of cast metal coupling screws, or boxes, screwed into the wood, for the purpose, and in the manner, set forth; and I also claim the manner of constructing the lower valve, the whole being constructed and operating substantially as described."

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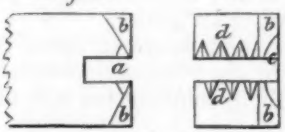
12. For improvements in machinery for *Cutting the Threads on Wood Screws;* Farwell H. Hamilton, Schenectady, New York, July 8.

In this machine there are two spindles, each carrying cutting dies; these spindles are placed side by side, and parallel to each other; each of them carries a pinion that takes into the teeth of a cog wheel placed between them, said cog wheel receives a reciprocating motion from a rack connected with, and moved back and forth by, a crank. The opening and closing of the dies, and the receding and advancing of the spindles, to form the thread, are effected as in some other screw machines. In front of the die end of each spindle there is a feeding wheel, with appropriate jaws for receiving and holding the blanks; an oil tube for supplying oil to the dies whilst cutting, is attached by the middle to a rocking shaft, which is connected with one of the spindles, that as they are turned in opposite directions, and as one is advancing and cutting the thread on a screw, and the other is retreating, the oil tube is shifted to supply the oil to the dies that are in the act of cutting. The dies are made in the manner represented in diagram 1 and 2. They have a nick in the end *a*, of sufficient depth to make the thread deep enough, without having the dies come together. They are then filed away, beveling on each side from the nick, excepting the leaving a lip, *b*, *b*, in which there is a countersink, *c*, to enable it to run readily on to the blank. After these dies are put into their places, a tap is run in, which, instead of cutting threads on them, cuts the teeth, *d*, *d*.

Fig. 1. 2.



Claim.—"What I claim as my invention, and desire to secure by letters patent, is, 1st. The arrangement of machinery which operates the oil tube, and its combination with the machinery which gives to the spindles an opposite and alternate rotary motion, in the manner, and for the purpose, described. 2d. The method herein described of making the cutting part of the dies with teeth instead of a thread, in combination with the lips, as above described."

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13. For an improvement in the *Smut Machine,* for Cleaning Wheat, &c.; Henry A. Buck, Fredonia, Chautauque county, New York, July 10.

The outer case of this smut machine is cylindrical, the inner sur-

face being fluted, and within this revolves a set of beaters, which are attached, at top and bottom, to an annular ring, the lower one only being attached to the shaft by arms. Within this set of beaters there is a stationary cylinder, or cage, made of square or triangular bars, placed sufficiently far apart to allow chaff and dust to pass between them, but not the grain; its cover, which extends a little above the upper ends of the beaters, is perforated with numerous holes, and above this is a set of wings, attached to a vertical shaft, that passes through the middle of the inner cylinder; the beaters are attached to the shaft by a set of arms below the lower end of the inner cylinder. The grain is fed in at, or near, the top of the machine, and enters the space between the inner and outer cylinders, and in passing to the bottom, where it is discharged, it is cleaned by the beaters, the chaff, dust, &c., being carried through the openings of the inner cylinder, and discharged at the top by an upper current, produced by the centrifugal action of the wings at the top.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the revolving frame, or beaters, with the inner and external cylinder, constructed and operating as above set forth."

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14. For an improvement in the *Revolving Cultivator;* George Whitlock, Crown Point, Essex county, New York, July 10.

The harrow teeth in this cultivator are attached to three rollers, which revolve in a triangular frame, the axes of the rollers forming a triangle. These rollers are all geared together by means of beveled cog wheels. There is a double plough at the forward end of the frame, as in the common triangular harrow, or cultivator.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the arrangement of the side and transverse revolving harrows, operated in the manner set forth, in combination with the frame and plough, as before described."

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15. For improvements in *Bridges;* Earl Trumbull, Little Falls, Herkimer county, New York, July 10.

This bridge, as described, is to be constructed of iron. It consists of arched truss frames, made in sections, the end of each section having a half post, and this, when united and tied to the half post of the next section, forms an entire post. These sections are farther sustained and connected together by suspension rods, which run from the upper part of one end section to the other, passing under the bottom of the middle section; and by tie rods that run from end to end along the lower line of the truss. The truss frames are connected together by transverse cast iron beams, or sills, on which the floor is laid, formed of a bottom and top plate connected together by diagonal braces, all cast together. In addition to these, the trusses are farther connected by diagonal tie rods, running from section to section, under the floor.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the suspension rods with the truss frames, made in sections, for the purpose and in the manner specified, and in combination with these, thus combined, I also claim the tie rods, as specified. I also claim the particular construction of the cast iron beams, or sills, by uniting together, in casting, the two plates, upper and lower, as described, with the diagonal bracing, as described."

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16. For an improvement in the *Wrench;* James Brett, Newburgh, Orange county, New York, July 10.

The sliding jaw, in this wrench, is provided with teeth fitting into corresponding teeth on the upper edge of the bar, and these prevent the jaw from sliding when the parts are held by a wedge which passes through a mortise in the jaw, and bears on the back edge of the bar.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the teeth on the slide, and their combination and connection with the teeth on the bar. I make no claim, whatever, as the inventor of any other part of the wrench."

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17. For an improvement in *Locks for Doors, Chests, &c.;* David Evans, Philadelphia, Pennsylvania, July 10.

"The main feature of this invention consists in the providing of a sliding plate, or cover, by which the key hole is to be closed spontaneously on withdrawing the key, and that in such manner as that the key cannot be made to enter the lock until a catch is raised, and a shaft, or handle, turned, by which the plate is made to slide back to the required distance, when the key may be readily inserted. The part by which this catch is raised, and the handle, or shaft, by the revolution of which the covering plate may be made to slide back, may be varied in numerous ways, and must, in fact, be so varied, in order to adapt the invention to the kind of lock employed, and the article to which it is appended. The sliding plate is case-hardened, where it covers the key hole, so that it cannot be drilled, or cut, by any tool."

Claim.—"What I claim therein, and desire to secure by letters patent, is the causing of a metallic plate to slide over and to close the key hole of a lock, in such manner as not to require any care on the part of the person withdrawing the key, so that a key cannot be inserted until said plate is removed; which removal is to be effected by the aid of two concurring motions, by one of which the plate is unlatched, or released, from a catch, and by the other of which it is made to slide, so as to cause a hole in said sliding plate to coincide with the key hole; the respective parts by which these effects are produced, being constructed, arranged, and operating substantially as herein set forth."

18. For improvements in *Piano Fortes;* Lemuel Gilbert, Boston, Massachusetts, July 10.

The claim is to the "constructing the centre block of the hammer with an arm projecting below its centre of motion, and having a regulating button attached thereto." To making the "jack without a regulating button, so that the fly may abut upon, or against, a long strip of cloth, or wash leather, applied to the rear of the top of the same, thereby in a high degree preventing noise in the action of the same, in combination with a hammer having its centre block constructed with the arm and regulating button." Also to a "jack having a regulating button in combination with a hammer, whose centre block is constructed as described." And finally, to "loading the centre block of the hammer."

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19. For improvements in the *Argand Burner,* for burning Camphine and other chemical oils; Stephen J. Gold, Cornwall, Litchfield county, Connecticut, July 16.

The claim is to the "mode of compressing the wick by means of two thin, movable, metallic, cylindrical tubes, combined with the wick case, the two cylinders, or wick tubes, with the wick compressed between them being inserted into the annular space between the two cylinders of the wick case, with a portion of said wick tubes extending above the wick case, to allow of their being kept cool by the draught; and also for combining with the outer cylinder of the burner and the rod supporting the button, a movable cylinder, or screw, disconnected from the rod, but having a button plate which, when the cylinder is turned up, presses against the rod and elevates it; and allows it, when turned down, to return either by its own weight, or by the action of a spring."

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20. For an improvement in the *Process of Vinous Fermentation;* Charles O. Wolpers, Cincinnati, Hamilton county, Ohio, July 16.

We are informed by the patentee, in his specification, that the "Nature of his invention consists of the method of conducting vinous fermentation in close vessels, by combining a series of close vessels with one or more open or shut vessels, as the case may require, containing a solution to be charged with carbonic acid gas."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the method, or process, of conducting vinous fermentation in close vessels, by fermenting the beer, or wash, in a series of close vessels, or vats, combined and operating in the manner set forth."

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21. For an improvement in the *Tobacco Press;* Elliott Richardson, West River, Anne Arundel county, Maryland, July 16.

This patent is for an improvement in the vertical screw press, to be worked by horse power, and is a modification of that kind of press in

which the nut, through which the screw passes, turns, instead of the screw. The lower part of this nut is made with a flanch, and its upper part is poligonal, to receive and be secured to the horse sweep. The upper cross head of the press is provided with a plate of metal, through a hole in which the screw passes, and on this plate the revolving nut rests; a second plate is passed over the nut, embracing the flanch thereon, and is bolted to the head beam; in this manner the nut is held down, whilst it is left at liberty to revolve. To the head beam there is attached a cross piece, at right angles to it, from which descend two rods, or studs, one on each side of the hogshead, for the "purpose of steadying" and keeping the hogshead and the pressing screw in a vertical position.

Claim.—"I do not claim as of my invention, the actuating of the screw by the revolving of the nut. But I do claim the manner of forming and combining the nut and metallic box, as set forth, in conjunction with the combining them with the head block, by means of which arrangement the press can be conveniently worked by horse power, whilst the head block of wood is left of such strength as to render it perfectly efficient. I claim, also, in combination with the foregoing arrangement, the employment of the studs affixed in the manner described, for the purpose of steadying and keeping the hogshead and screw in a vertical position."

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22. For a combined percussion and reaction *Water Wheel;* Clark Lewis, Syracuse, New York, July 16.

This wheel is surrounded by a "stationary rim," with eight or more apertures at equal distances apart, through which the water is admitted to the wheel. The inner sheathing of the wheel is conical, and the upper and lower rims are of the same diameter, the inner edge of the upper one being united to the conical sheathing, by which an annular opening is formed at the bottom, between the lower edge of the conical sheathing and the inner edge of the lower rim, for the discharge of the water. That face of the buckets against which the water impinges when it enters the wheel, is radial, and is then curved until it reaches the lower edge of the conical sheathing, so as to form a reacting bucket.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the manner in which I construct the buckets of my wheel, as set forth, so as to discharge at" (should be towards) "the centre, and produce a reaction, as well as a percussion effect, in combination with the stationary rim, having apertures in it for admitting the water to the wheel, the whole being constructed substantially in the manner, and for the purpose, above described."

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23. For improvements in the *Smut Machine* for Cleaning Wheat and other small grain; Thomas R. Bailey and Ezra Rich, the former of Weybridge, and the latter of Shoreham, Addison county, Vermont, July 16.

The patentees say:—"Our machine consists of two hollow, coni-

cal frustums, or cylinders, of cast iron, the outermost of which is stationary, whilst that within it is, when used for cleaning grain, to be made to revolve with great rapidity; each of these frustums, or cylinders, is to consist of strips, or staves, of cast iron, which are to be confined in place by means of suitable grooves, or depressions, cast on the heads, or rims, by which the ends of the staves of each frustum, or cylinder, are to be received and held together. Between each of the staves, or strips, which form the peripheries of each of the cones, or cylinders, there is to be a slot, or opening, extending along its whole length, for the passage of air."

"What we claim as constituting our invention, and desire to secure by letters patent, is the arranging of the staves which constitute the outer case, or stationary frustum, or cylinder, so that they shall overlap each other to a small distance, and at the same time leaving a space between each contiguous stave for the passage of air, smut, and other impurities from the grain, whilst the grain itself is prevented from passing through. We also claim the manner of constructing the inner revolving frustum, or cylinder, by forming the same of cast iron staves, so combined as to overlap each other, and to leave a space of a fourth of an inch, more or less, between them, for the passage of air, to be supplied from without the apartment; the whole being arranged and combined together substantially in the manner set forth."

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24. For an improvement in the *Reaction Water Wheel;* Nathaniel F. Hodges, Carning, Steuben county, New York, July 16.

"The distinguishing features of this wheel are, first, that its general form is that of a segment of a hollow sphere, each of the individual buckets, which by their combination, give to it this form, being also segments of hollow spheres; and secondly, in causing the openings between these buckets, through which the discharge of water takes place, to extend from the periphery of the wheel to the eye, or opening, through which the shaft passes. There is not, therefore, on the face of this wheel, any back, or bottom, plate, or imperforated portion upon which the water presses without having a tendency to turn the wheel." So says the inventor.

"What I claim therein, and desire to secure by letters patent, is the so constructing the wheel, as that each of its buckets shall constitute a segment of a hollow sphere, and that these shall be so arranged and combined with each as that the openings for the discharge of water shall extend from the outer rim to the eye, or shaft, and the wheel itself, thus constructed and combined, shall constitute a segment of a hollow sphere, as set forth."

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25. For improvements in the *Portable Saw Mill,* for Sawing Timber with the Circular Saw; George Page, Baltimore, Maryland, July 16.

In this mill, the shaft of the circular saw has its bearings longer than the width of the boxes in which they run, so as to allow it to

have free end play, and the saw is embraced on each side, just back of the teeth, between two friction rollers, which serve to guide it. Each of the guide rollers is attached to a separate plate, the two plates being placed one above the other, and provided with a slot for securing and setting the rollers. The carriage is made in sections for the convenience of transportation, the different sections being united by means of a rack rail at the bottom.

Claim.—"What I claim as my invention, &c., is the manner of affixing the circular saw, by allowing end play to its shaft, in combination with the means of guiding it by friction rollers embracing it near to its periphery, so as to leave its centre entirely unchecked laterally. I do not claim the use of friction rollers, embracing and guiding the edge of a circular saw, these having been previously used for that purpose, but I limit my claim to their use in combination with a saw having free lateral play at its centre. I claim the particular manner in which I have applied said friction rollers, by attaching the pins, or pivots, upon which they are sustained and revolve, to two plates of metal placed upon each other, and both held by the same set of screws, as set forth. I claim the manner of forming a long carriage from two short sections, by coupling, or uniting, said sections, by means of the rack rail only, as described."

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26. For an improvement in the *Machine for Cleansing Wool and Cotton;* William W. Calvert and Alanson Crane, Chelmsford, Middlesex county, Massachusetts, July 16.

This "improvement in the machine for separating burs, seeds, and other foreign substances, consists in our substituting for the knife, or guard, which has ordinarily been employed to arrest and separate the burs, seeds, &c., a revolving roller, which is fluted, or channeled, from end to end, or which is otherwise so formed and constructed as to cause a number of projecting edges to strike in rapid succession against the foreign matter which is to be separated from the fibres, and thus to clear, or pick, such matter out by an operation analagous to that of picking it out by the finger nail."

Claim.—"What we claim therein as our invention, and desire to secure by letters patent, is the employment of a revolving, fluted, or channeled, cylinder, or of any analogous revolving apparatus, which will present in rapid succession a number of picking, or clearing, edges, to operate upon the burs or other foreign matter contained in wool or cotton, in combination with the fine comb cylinder and the picker cylinder, or other apparatus analogous thereto, by which wool is carried up, and presented to the action of the revolving, fluted, or channeled cylinder, as described."

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27. For a method of making *Indelible Ink;* Thomas J. Spear, New Orleans, Louisiana, July 16.

The following is the whole of the specification, viz:—"Take three drachms of the least bruised India ink, and four ounces of boiling solution

of caustic soda, and mix these together, and shake the mixture well for about ten minutes, when the indelible ink is produced. What I claim as my invention and discovery, and which I desire to secure by letters patent, is the before described indelible ink."

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28. For an improvement in the *Shoemakers' Paring Knife;* Isaac S. Pendergast, Barnstead, Belknap county, New Hampshire, July 16.

The patentee says:—"I do not claim to be the first to have constructed knives for paring the soles of shoes with fenders, or guides, to prevent the knife from cutting the upper leather, but what I do claim is the combining with the blade of the knife, a shield, or cap, in the manner described, viz: by forming the cap with a straight shank, flat upon one side, that it may rest upon the blade, and inserting the end of the same into the socket by the side of the blade, as described; by means of which arrangement, I am enabled to give greater strength to the blade, and at the same time protect the upper leather from being injured."

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29. For an improved mode of *Heating Water for Leaching Ashes;* Joseph H. Ward, Randolph, Portage county, Ohio, July 16.

We are informed by the patentee, that the "nature of his invention consists in providing a vessel, in which ley is boiled, with a cover, or lid, sufficiently tight to prevent the escape of steam, except through a tube which conducts it into the water which is to be heated, for the purpose of leaching ashes.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the leach tub and reservoir of hot water with the boiler in which the ley is evaporated, by means of a tube, or tubes, for conducting steam from the boiler to the reservoir, for heating the water in the same, the whole being constructed in the manner, and for the purpose, set forth."

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30. For an improved machine for *Cutting and Gathering Flax and Hemp;* Richard M. Cooch, Lambertsville, Hunterdon county, New Jersey, July 16.

This machine is, in its general construction, like that for which a patent was granted to William Britain and John Silvers, on the 25th of November, 1838, and noticed in this Journal, vol. xxiv of the second series, page 323, to which the reader is referred for a general description of its construction; the improved machine differs essentially from the former in its being made to cut the flax, or hemp, close to the ground, instead of being a "machine for pulling flax and hemp." The flax, or hemp, is caught between a horizontal drum and a system of endless belts, there being a projecting arm, or gathering piece, which conducts it to the drum, and whilst it is held and carried forward by the drum and belts, it is cut off, close to the ground, by a

revolving knife, which is operated by the system of belts employed to catch and hold the hemp, &c.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combining of the revolving knife with the drum, the gathering piece, and the endless bands, as herein described, so as to convert the said machine from one for pulling flax and hemp, into one for cutting and delivering the same, the whole being constructed and operating substantially as set forth."

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31. For improvements in the machine for *Cutting Crackers;* Charles P. Forbes, Baltimore, Maryland, July 16.

In this machine, the dough, after being rolled, passes on to an endless belt, in the usual way, but instead of pressing the cutters down on to the belt, on which the dough is placed, the belt is pressed up against the cutters, which are arranged above it, there being a curved plate placed under the belt for this purpose. This plate, the curved surface of which is a segment of a cylinder, is hung by two cords passing over pullies, and provided with weights, to press it up against the cutters. When the dough is passed under the cutters, the attendant rolls the curved surface of the plate against the under surface of the belt, by which operation the crackers are cut.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is making the edge of the outside cutters project beyond the edge of the inside cutters, and have the points of the dockers on a level with the edge of the outside cutters, as herein described, so as to dock and cut the outside edge through, whilst the inner cutters do not cut sufficiently far to separate the crackers. I also claim the method, herein described, of cutting the dough, by having the cutters and dockers permanent, and pressing the upper part of the belt, or apron, on which the dough is placed, up against the cutters and dockers, by means of a curved plate attached to a lever, drawn up by weights, and guided by hand, in the manner described."

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32. For an improvement in the machine for *Cutting Sheet Tin, or other Sheet Metal, and Glass;* Andrew Tracy, Poughkeepsie, Dutchess county, New York, July 17.

This machine differs very little from other machines for the same purpose, which have been patented. The plate of metal to be operated on is held between two plates, each of which is attached to a rotating spindle, the uppermost being provided with a spring, which bears it up when not acted upon by an eccentric lever, by which it is forced down, to hold the sheet of metal. The spindle of the upper plate is provided with a lever, with which to turn it when desired; it is furnished with a pall, which catches into the teeth of a ratchet wheel attached to the spindle. In operating with this machine, either the holding plates, with the sheet metal, may be made to turn, or the shears may be carried around the holding plate, at pleasure.

Claim.—"What I claim as my invention, and desire to secure by

letters patent, is, first, attaching the upper rotary shear to a hinged piece, regulated by a thumb screw, for the purpose, and in the manner, specified. Second, attaching the stock of the shears to a lever revolving around the centre of the holding plates; and third, the combination of the lever and ratchet with the upper holding plate, for turning the metal, or glass, as herein described."

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33. For an improvement in the form of *Spikes and Nails;* William Ballard, New York city, July 17.

This improvement in spikes, or nails, consists in making offsets, or indentations, on the opposite sides of, or around, their shank, which offsets, or indentations, are to be in such form as not to cut, or tear, the wood, as is the case with those which have projecting points, or serrated edges, formed upon them, by means of a cold chisel, or by some analogous means, in the manner which has been frequently resorted to. These spikes are also provided with a secondary head below the main head, but of less size, over which the wood will close, and thus make it adhere more firmly.

Claim.—"What I claim as constituting my invention, and desire to secure by letters patent, is the forming of spikes, or nails, with offsets, or indentations, which offsets, are without sharp, or cutting, edges, so that when driven they shall not injure the wood, but shall hold firmly, by the collapsing of the wood upon them. I also claim the forming of the secondary head, for the purpose, and in the manner, set forth."

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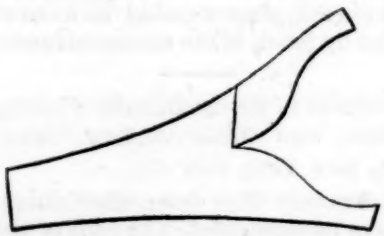
34. For an improvement in the method of *Cutting Leather for Making Horse Collars;* Thomas Parkinson, Sparta, Livingston county, New York, July 17.



Claim.—"What I claim as new, and desire to secure by letters patent, is the cutting of the leather which is to constitute the covering of the collar, to a pattern substantially in the manner of the two pieces represented in the accompanying drawing, preserving in all variations of size, the relative proportions of the respective parts, as made known."

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35. For an improvement in the machine for *Working and Pressing Butter;* Titus D. Gail, Eden, Erie county, New York, July 20.

This machine constitutes an improvement which has been added

to a patent granted on the 10th of October, 1840; the original patent is noticed in vol. ii of the third series, page 392. Instead of the permanent table, pierced with two holes, and provided with pistons working from below, and having a trough above it, as in the original machine, the table is made to slide under the trough, and is provided with several sets of holes and pistons, to receive and work the butter.

Claim.—"What I claim as constituting my improvement upon the machine originally patented by me, is the employment of the sliding table and the stationary trough, constructed and operating in the manner set forth, in lieu of the apparatus employed for the same purpose in the original machine, by which the instrument is much simplified in its construction, and rendered more convenient in use."

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36. For an improvement in the *Ring Groove Spinner;* David Hunter, Laurel Factory, Prince George county, Maryland, July 23.

In this improved spinner ring, with the hooks, or wires, through which the thread passes, and which carry it, is attached to the lower ends of the flyers, and works either in a circular concave, or between four grooved rollers, instead of working independently of flyers, as heretofore.

Claim.—"What I claim as my invention, and which I desire to secure by letters patent, is the construction of the ring spinner, when attached to the flyer rods, in combination with the circular concave seat, or rollers, in which it turns, as described."

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37. For improvements in the *Sofa Bedstead;* James M. Meschutt, city of New York, July 23.

This sofa is changed into a bedstead by stretching a sacking across from the upper part of the back to a rail in front, which is attached to two pieces hinged to the upper part of the two front pillars, and folding on to them, and these, when closed down, form the ornamental part, or facing, of the pillars. There is a brace hinged to the front rail, for the purpose of stretching the sacking when the frame is thrown up.

Claim.—"I am aware that a patent has been granted for a sofa bedstead, on the principle of the cot bedstead, in which a frame, hinged to the front of the sofa, is employed, and I do not therefore simply claim the employment of a frame, hinged to the front of the sofa; but what I do claim as my invention, and desire to secure by letters patent, is the adaptation of an extra frame to the front of the common sofa, connected by hinges to the tops of the pillars, and supported at the extremities by the legs, in combination with the brace which slides through the front rail when the extra frame and legs fold down against the pillars and front rail of the sofa, for the purpose, and in the manner, specified."

38. For a Compound to be used in the Cure of *Syphilis, &c.;* Silas Thurman, Lincoln, Kentucky, July 23.

The compound which is the subject of this patent is to effect the cure of syphilis, gonnerhœa, buboes, gleet, leuchorhea, &c. The recipe is as follows: "Take 12 lbs. green poke root, which is to be cut small, and boiled in 16 gallons, [water we suppose,] until reduced to half a gallon; let this cool, and press and strain it. This constitutes the first portion of the tea. For the second, take 7 oz. dry sarsaparilla, put half of this into 3 pints of whiskey, and let it remain until the strength is extracted. Then take 12 oz. cedar tops; the half portion of sarsaparilla; rattle weed, 4 oz. of the root; and half a pound of sumach, and put them into 16 galls. of water, and boil down to half a gallon. Add this to the first tea, together with the extract of sarsaparilla in whiskey, and it is fit for use. For syphilis, take 2½ drachms of sulphur, night and morning; take epsom salts, also, to keep the bowels open, and every morning, noon, and night, take 3 oz. of the tea. Get bled every few days, until the blood becomes of a pure and natural color." "In any common case of all the above described diseases, ten or twelve days will effect a perfect cure, unless calomel has been taken, then it will require longer." "Calomel is prohibited in all cases; but in cases of syphilis, the ulcers must be greased every time after washing, with red precipitate; [ointment, probably.]

"What I claim as my discovery, and desire to secure by letters patent, is the compound formed by the above described ingredients and process; using for that purpose a smaller or greater quantity of the same ingredients, to make a smaller or greater quantity of the compound."

As may well be supposed from the general texture of the foregoing description, the original specification displays an abundant lack of knowledge upon the subject to which it refers, and we really think the application was one which ought not to have received the sanction of the seal of the patent office. The compound is analogous to such as have been frequently made, and offers no substantial novelty, whilst the effect claimed to be produced by it, will not be attained, and proceeds from entire ignorance of medical science. It is, therefore, like most patented medicines, a fraud upon the public.

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39. For an improved *Measure for Liquids;* John S. Tough, Baltimore, Maryland, July 23.

The lower part of the measure, above referred to, is to be funnel shaped, and provided with a valve, or spigot, which, when opened, permits the liquor to escape into any vessel, without the trouble of pouring out, and using a separate funnel. The instrument is divided into sections of different diameters, each diameter forming a measure of different capacity.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is combining with the ordinary measure for liquids, a funnel governed by a spigot, or valve, for allowing the liquid to be

let off, as set forth; and also the combining two or more of the common measures for liquids in one piece."

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40. For an improvement in the *Cooking Stove*, called the "Franklin Economy Cooking Stove;" Mathew Stewart, Jr., Philadelphia, Pennsylvania, July 23.

This stove contains a reflecting oven, the form of which is that of two truncated pyramids, united at their bases, the inclined surfaces being intended to concentrate the heat in the centre. Each end of the oven is attached to a semi-cylindrical furnace, the chords of which are towards the centre of the oven. Over the furnaces there are openings for smoke pipes, and for cooking utensils.

Claim.—"No claim is made to the combination of an oven with a furnace, or heater, at each end of it; but what I do claim, and desire to secure by letters patent, is the peculiar construction of the heat reflecting oven, as described, in combination with the two semi-circular stoves, with funnel-shaped caps, for saving fuel and cooking expeditiously, as before described."

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41. For an improvement in the *Mill for Manufacturing Flour;* Andrew D. Worman, Fredericktown, Maryland, July 23.

The middlings, which are to be mixed with the fresh ground chop from the burs, are put into a hopper prepared for that purpose, which hopper is so placed that the middlings contained in it shall be conducted from it into the spout, or trough, in which the elevators are carrying up the fresh ground wheat to the hopper boy; and to the hopper containing the middlings is appended a shoe and a sliding shutter, in the ordinary way, for the purpose of regulating the feed from them. In this way the middlings will be perfectly and equally distributed and mixed among the fresh ground chop, and will be, in this state, carried through the respective processes to which the flour is subjected, until it is ready to be packed.

Claim.—"What I claim as constituting my invention, and desire to secure by letters patent, is an improvement in the process of manufacturing flour, by conducting the middlings into the trough of the elevators, by means of a spout leading into it, and governing the feed by a hopper and shoe constructed in the usual manner, so that said middlings shall become equally and intimately mixed with the flour, and will, in the subsequent steps of the process, be entirely, or nearly so, brought into the state of superfine flour."

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42. For an improvement in the *Cotton Gin;* Lewis G. Sturdevant, Delaware, Delaware county, Ohio, July 23.

In the cotton gin which is the subject of this patent, instead of the cylinder of saws ordinarily employed, there is a cylinder, the surface of which is covered with fine teeth, and over this there is another cylinder, provided with beaters, consisting of strips of iron placed

edgewise, and extending from end to end thereof. As these revolve, the beaters on the upper, are brought nearly into contact with the teeth on the lower, cylinder, the space between them being merely such as will allow the fibres of cotton to pass, whilst the seeds are beaten back, and separated from the fibres by the action of the beaters. The cotton is to be removed from the teeth by a brush cylinder, in the usual manner.

Claim.—"What I claim as new, and desire to secure by letters patent, is the separating the cotton from the seed, by the combined operation of a cylinder covered with fine teeth, formed in the manner of saw, or rasp, teeth, and of a beater cylinder, arranged and operating as herein set forth; the other parts of the gin being constructed in the usual manner, I also claim the forming of the toothed cylinder, by winding around it a cylindrical coil of wire, prepared and cut with teeth, as described."

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43. For an improvement in a Surgical Instrument called the *Speculum Ani;* Joseph T. Pitney, Auburn, Cayuga county, New York, July 23.

That portion of the patented speculum ani which is to enter the rectum, consists of two blades which are convex on their outer, and concave on their inner, surfaces; they are made tapering, or conical, diminishing in size from the handles to their outer ends. The edges of this part are carefully rounded off, and made perfectly smooth. These blades are attached to forceps handles, the two portions standing at an angle of about one hundred and twenty degrees, more or less, with each other; through one of the handles passes a set screw, by which the blades may be more gently opened, and retained in any position.

Claim.—"I hereby declare that I claim, as of my invention, the manner in which I have formed and combined the respective parts; that is to say, I claim the forming of a speculum ani with tapering, or conical, blades, united at their larger ends to forceps handles, standing at a suitable angle with the blades, to admit of the ready inspection of the parts, and furnished with a set screw to regulate the opening of the blades, by which combination and arrangements of its parts, the instrument is rendered more effective, and more convenient in use, than such as have been heretofore made for the same purpose."

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44. For an improvement in the *Mill for Granulating Corn, Powder, Bark, &c.;* Increase Wilson, New London, Connecticut, July 23.

The mill which is the subject of this patent, purports to be an improvement on the ordinary cylinder mill. It consists of two cylinders, differing in diameter, and revolving with different velocities. Angular grooves are turned around these cylinders, and upon the projecting angle of each, teeth are formed, and the toothed projections on one of the cylinders, are received within the grooves in the other.

Claim.—"What I claim as my invention, and desire to secure by

letters patent, is the peculiar manner of arranging the cylinders, so as to have the cutters on each cylinder enter and run in the scores, or spaces, in the other cylinder, as described."

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45. For an improvement in the *Smut Machine*, for cleaning Grain; Samuel Bentz, Boonsboro, Washington county, Maryland, July 23.

Within a perforated cylindrical case, armed with beaters on the inside, are two sets of beaters, one within the other, which turn in opposite directions. The axes of these beaters are horizontal. The grain is fed in through an opening at the top, and passes out through an opening at the bottom; and in falling, it is met by a strong horizontal current of air from a fan, which carries off all the lighter matters leaving the grain to fall through an aperture in the lower part of the air trunk, below that in the lower part of the perforated case.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the arrangement of the cylinders of beaters, the one set of beaters revolving within the other set, in contrary directions, in an armed perforated cylindrical case; in combination with the fan, trunk, and gearing; arranged in the manner set forth, for separating smut, white caps, hulls, chaff, and all kinds of impurities, from the several kinds of grain which the machine is adapted to clean."

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46. For an improvement in the "*Universal Mill;*" James Bogardus, city of New York, July 29.

The mill upon which this is an improvement was patented by Mr. Bogardus on the 18th of January, 1832, and is noticed in this Journal vol x, 2nd series, page 34. By reference to this notice its general construction will be ascertained, and the subjoined claim designates the improvement.

Claim.—"What I claim as my invention, and desire to secure by letters patent, in combination with the manner of placing the upper stone, or plate, a little off the centre of the lower stone, or plate, (which I have already patented,) is, firstly, the construction and use of one or more circular grooves in either one, or in both, of the stones, or plates, as before described, or in any other manner substantially the same, to accelerate the feeding, and to produce, besides the hulling or grinding action, a cutting action like that of shears. Secondly, the combination of the upper shaft with the upper stone, or plate, in the manner hereinbefore described, or in any other manner substantially the same, to operate, in combination with other parts described, for the purposes of hulling seeds, grinding drugs, paints, dye stuffs, bread stuffs, &c.; or cutting fruits, &c."

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47. For an improvement in the form of the *Harpoon for taking Whales;* William Carsleys, New Bedford, Bristol county, Massachusetts, July 29.

The flukes, or barbs, of the harpoon above designated, are to be so

twisted as that after being thrown, it shall, on entering the body of the animal, cut its way in an oblique or spiral direction.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the twisted form of the barbs, or flukes, of the harpoon."

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48. For an improvement in *Self-setting Saw Mill Dogs;* Linus Yale, Newport, Herkimer county, New York, July 29.

The bale of the improved dog is jointed to the upper part of a sliding nut, which is made in two parts, an upper and a lower plate, bolted together. These two plates at their junction embrace two ways on which they slide. The screw that passes through this nut has on its outer end, beyond the end of the head block, a ratchet wheel permanently attached to it, and outside of this a hand lever, with a hand to catch into the notches of the ratchet wheel, for the purpose of turning the screw to set the log; and outside of the said hand lever, and turning freely on the stem of the screw, is an elbow-lever, one arm of which, by means of a pin projecting from its side, acts upon the hand lever, and thus upon the screw and dog, and the other strikes against a pin attached to the floor, as the carriage reaches the end of its course, by which the whole is put in motion, and the log set for the next cut.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is not the principle of the screw, hand lever, notched wheel, or iron band, as others of a different form have been used; but what I do claim is, first, the nut in combination with the wrought iron dog, as herein described. Second, the self-setting lever in combination with the hand lever, notched wheel, and screw, for the purpose, and in the manner, specified."

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49. For a method of making *Knobs for Doors, Locks, &c.;* John G. Hotchkiss, John A. Davenport and John W. Quincy, city of New York, July 29.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the manufacturing of knobs of potters' clay, or any kind of clay used in pottery, and shaped and finished by moulding, turning, burning, and glazing; and also of porcelain."

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50. For an improvement in the machine for *Cutting Screws on the Rails of Bedsteads;* Joel Thompson, Cynthiana, Harrison county, Kentucky, July 29.

The machine above named is a modification of one in general use, for cutting the screws on the ends of bedstead rails, and consists of a stock attached to a standard, which has the usual V cutters for cutting the threads; and forward of this there is a guide, consisting of an aperture of sufficient size to receive the body of the rail, so as to insure the cutting of the threads concentric with the body of the rail. In the stock there is a gauge, which fits into a mortise in said stock,

and is joined to it, and against this, when dropped down the shoulder of the rail bears before the stock screw, by which the rail is turned, is attached to the rail, so as to insure the cutting of the screw on each end of the rail to the same point. There are two guide apertures, and an equal number of cutters and gauges, one set for a right, and the other for a left, hand screw.

Claim.—"The invention claimed, and desired to be secured by letters patent, consists in the arrangement of the stock in combination with the guide apertures, made of sufficient capacity to receive the body of the rail, and the gauges in said stock in the standard, for determining the true position of the rail in cutting the right and left screws thereon, as set forth."

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51. For an improvement in the *Manufacture of Buttons;* Thomas Prosser, Paterson, Passaic county, New Jersey, July 29—anti-dated January 29, 1841.

The buttons which are the subject of this patent are to be formed of clay, or other earthy materials, and metallic oxides, such as are now commonly used by potters in domestic earthenware; they are to be made in metallic moulds, in which the materials are compressed with considerable force.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the manufacture above mentioned, consisting of buttons formed of compressed clay, or other earth materials, as set forth."

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52. For an improvement in the mode of *Combining Levers and Springs, to sustain the bodies of Wagons and other Carriages;* Elihu Ring, Trumansburg, Tompkins county, New York, July 29. (See Specification.)

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53. For an improvement in the manner of constructing and applying the Springs used as *Bumpers and Draught Springs*, in Railroad Cars, &c.; Fowler M. Ray, Cattskill, Greene county, New York, July 29.

The improved springs consist of flat and straight leaves, or plates, of spring steel, there being two or more leaves, either of equal or of unequal length, and so placed as to stand across the frame of the car, from side to side, where they are received in pockets, the sides of which, towards the springs, are so curved as that under an increased pressure the points of bearing are gradually approaching, and thus increasing the rigidity of the spring.

Claim.—"What I claim as new, and desire to secure by letters patent, is the combining of springs composed of straight leaves, or plates, of steel, in the manner set forth, with pockets curved at their sides, in such a manner as that the flexure of said springs shall cause them to diminish, progressively, in their effective length, and consequently to increase in their power of resistance. I claim, in combination with said springs and pockets, so constructed and arranged, the employ-

ment of the curved check pieces, to co-operate with the curved pockets when the leaves are all of one length. I claim, also, the substitution for said check pieces, and the combining with the long leaves, which extend to the bottom of the pockets, such number of shorter leaves as may be found necessary, and in the manner herein described."

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54. For an improvement in the *Portable Saw Mill;* James C. Mayo, Columbia, Fluvanna county, Virginia, July 29.

In this improved mill the log is stationary, and the frame in which the saw works moves up thereto, it being made to slide forward for that purpose. A rack attached to the movable frame passes over a pinion on the axle of a ratchet wheel, giving motion to it in the same manner that the carriage of the common mill is actuated. The saw, instead of being strained in a saw frame, is attached at its upper end to a block which slides in ways, and at its lower, to a crank which is actuated by a belt that passes around a drum on the shaft of the crank, and also around a drum at each end of the frame.

Claim.—"What I claim as new, and desire to secure by letters patent, is the particular combination and arrangement of the respective parts thereof, as set forth—that is to say, I claim the described manner of combining the saw with the sliding frame; the crank to which the lower end of the saw is attached having its bearings in said sliding frame, and the sliding frame being made to embrace the side pieces, and being otherwise combined, and arranged, and actuated, in the manner set forth. I am aware that a saw has been actuated directly by a crank at its lower end, and that a saw has also been made to move up towards the log by means of a sliding frame; but these have not been used in combination with each other, and I therefore limit my claim to this combination, under the arrangements substantially as above described."

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55. For improvement in *Fire Arms;* Charles Lewis Stanislas Baron Heurteloup, a subject of the King of the French, July 29.

The fire arms which are the subject of this patent are of the percussion kind. The compound employed for priming is contained in a small flattened lead tube; this priming tube is placed within a covered channel made in the under side of the stock, and from this it passes into a channel made in the lock plate, which is, for that purpose, made longer than usual, and attached to the under side of the stock. This plate has a large chamber made in it, in which the explosion of the priming, &c., takes place. The continuous priming is carried forward, at every reloading, by a cog wheel, which is turned by the thumb, the priming being pressed up against the cogs by a flat spring. At each discharge, a piece of this priming is cut off, by a cutter attached to the cock, is carried to the touch hole, and is there exploded, by the hammer.

Claim.—"What I claim, and desire to secure by letters patent, is, first the making of the large plate so as to adapt it to the reception of the mechanism which moves the continuous priming, also making therein

the chamber to receive the smoke, or deposit, caused by the ignited powder, in order that it shall not injure the different parts of the lock, which large plate also presents the peculiar characteristics of containing within itself the hole to receive the axis of the cock, the receptacle, or channel, for the priming, the chamber to receive the smoke, and the spitter, all within the same solid piece of metal, so that the distances between the various parts of the machinery herein described, being always fixed and invariable, the action of the parts shall not admit of any variation; all as described. Secondly, the making of a covered channel, for confining the continuous priming between the barrel and the stock, in the stock before the lock, from which it can be drawn towards the touch-hole; and in combination therewith, the priming conducting spring, which presses the priming towards the wheel; the wheel for moving it forward, or backward, and fixing it, all as hereinbefore described. Thirdly, the compressor with two shields which is fastened to the lock, in the mode, and for the purpose, specified."

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56. For an improvement in the mode of *Propelling Ships, Boats, and other Vessels;* Elisha F. Aldrich, city of New York, July 30.

In this improved mode of propelling boats, &c., the wheels are constructed with permanent radial paddles, the ends of which but against the rims of the wheels, so that the principal part of the water against which the paddles act has to pass in between them, through the space between the inner periphery of the rims and the centre, or hub, and is forced out by centrifugal power against the water back of the wheel—thus impelling the boat forward. The wheels constructed in this manner are placed either in hollow trunks, or cases, within the vessel, or in similar cases built outside, and open at the bottom, the wheels projecting below the bottom of the trunks, or cases—or they may, it is said, be placed horizontally, and act on the water at the sides of the vessel.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the method of propelling ships, boats, and other vessels, by means of wheels that receive water at the centre, or any distance from the centre, and throw it out at the periphery by the action of the centrifugal force, as herein described. I also claim the mode described and set forth of constructing wheels to be applied to vessels for the propulsion of the same, the wheels to revolve vertically or horizontally; and I claim, also, the mode of placing the wheels nearly, or quite, as low as the bottom of the vessel, to revolve within cases attached to the sides of the same, as described."

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57. For an improvement in the machine for *Planting Cotton Seed;* R. S. Thomas, Bennetsville, Marlborough District, South Carolina, July 30.

The bed piece of this machine rests on the ground, and is provided with a piece like a keel forward of the seeding roller, for making the furrow; that portion of the bed piece which is back of the seeding roller

is hinged to the forward part, so as to yield in passing over stones, &c. The seeding roller is made with ridges, or points, between the excavations for the seeds, for the purpose of agitating them to insure their falling into the excavations. This roller is carried round by two wheels on its axle, which run on the ground. The hopper rests freely on the seeding roller, that part of its surface which rests on said roller being covered with leather, or other yielding substance.

Claim.—"What I claim as new and desire to secure by letters patent, is the manner of constructing the seeding roller with alternate ridges, or points, and excavations for the reception of the seed to be planted; the ridges, or points, operating as agitators to keep the seed in motion, and cause it to fall into the excavations. I am aware that agitators have been frequently used within a hopper in seeding machines, but these have been constructed in a manner much more complex than that employed by me, which method is perfectly effective and simple, not requiring any additional moving parts. I claim the manner of forming the bed piece in two parts, the rear part being hinged to the forward portion in the manner described, and for the purpose of covering the seed that has been planted, and this I claim in combination with the ridge, or keel piece, for forming and preparing the furrow, said keel piece extending along the bottom of the bed piece. I also claim the forming the bearing of the hopper upon the planting, or seeding roller, by means of a piece of leather, or other elastic material, in the manner set forth."

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58. For an improved manner of constructing the *Grates of Kilns*, used for burning lime for the manufacture of Potash, or of Salt; William B. Hill, Bellevue, Eaton county, Michigan, July 30.

Claim.—"What I claim as new and desire to secure by letters patent, is the forming the combined bars, or fire supports, arranged as described, in part of metal, and in part of fire-proof, earthy compound, substantially in the manner, and for the purpose, described; and the combining of said compound fire supports with each other by means of a suitable frame, and of a rod, or bar, to which the swinging edges of each of them is jointed, for the purpose of opening or closing them in any required degree, by which means the draught may be regulated, and ashes, or other matter, may be readily discharged."

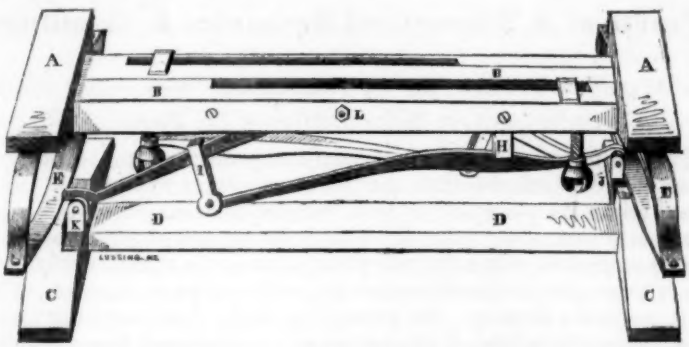
Specifications of American Patents.

Specification of a Patent granted to Elihu Ring, *of Trumansburg, Tompkins county, state of New York, for Graduating Springs for Carriages. Granted July* 29, 1841.

To all whom it may concern: be it known that I, Elihu Ring, of Trumansburg, in the county of Tompkins, and state of New York, have invented a new and improved mode of combining springs and levers, and of applying them so as to sustain the body of a wagon,

or other kind of carriage, and its load, in an advantageous manner, they being, by their peculiar construction, capable of being adapted to the amount of the load which they are intended to sustain; and I do hereby declare that the following is a full and exact description thereof:

These combined springs and levers may be arranged in various ways without changing the nature of their combination and action, which combination and action are clearly exemplified in the following drawing. In this, A, A, are the timbers upon which the wagon body is to rest, and which are framed together by means of the longitudinal timbers, B, B, which may be denominated the upper spring bars. The pieces C, C, sustain the axles, and are connected together by the longitudinal piece, or perch, D, D. Between the pieces A and C are the elliptic springs, E, E, which are of the ordinary kind, and are affixed in the usual manner. When the load is light, it is principally sustained by these springs. Instead of elliptic springs, others of any of the known kinds adapted to the purpose, may be used. F and G constitute a connected lever and spring, which are so combined as to be readily adjusted, so as to exert a greater or less degree of force, as may be desired.



The spring G rests against a fulcrum piece, or block, H; is connected at its outer end to the lever F, by means of the spring I, working on a joint pin. At its inner end the spring G may be drawn up by means of a screw nut and bolt, J. The lever F bears by its outer end upon a friction roller, K—its fulcrum being the bolt L, which passes through the timbers, B, B. The spring G is necessarily made very stout, as it is intended to act under the pressure of very heavy loads. A similar lever and spring are seen in the drawing, as acting on the opposite side of the frame; and this resembles that above described, in every particular, but stands in a reversed direction.

It will be seen, that by this arrangement of the springs and levers the whole action may be thrown upon the elliptic springs; that the levers and springs may be lightly strained together, so as to bear their portion of the load when it is increased somewhat beyond that to which the elliptic springs are adapted; or that they may be brought to a high degree of tension whenever the nature of the load renders

it desirable that this should be done. The upper and lower portions of the frame may advance and recede with perfect freedom, the outer ends of the levers, F, playing backward and forward upon the friction rollers, the spring G acting unobstructedly by the play of its end upon the jointed stirrup.

Having thus fully described the manner in which I combine and arrange the respective parts of the apparatus used by me, what I claim therein, and desire to secure by letters patent, is the combining with the elliptic, or other springs, occupying the situation in which they are represented—the combined levers and springs, F and G, being so connected and arranged as to operate substantially in the manner herein set forth.

These springs and levers may be increased in number; they may be placed in an inverted position, and changed in form, without materially changing their nature and action; and I do not, therefore, intend to limit myself in these particulars, but to introduce any variations which I may think proper, whilst the same result is attained by means substantially the same.

ELIHU RING.

Practical & Theoretical Mechanics & Chemistry.

MR. MALLET'S *Processes for the Protection of Iron from Oxidation and Corrosion, and for the prevention of the Fouling of Ships.*

The discovery of an effectual means of protecting iron, copper, and other metallic surfaces, from the injurious effects of exposure to atmospheric and aqueous influences, had long been an object of earnest, but nearly unavailing pursuit, as well among men of science as among mere practicians, when the successful application of iron to the building of ships gave suddenly a new impetus and great increase of importance to the inquiry. Sir Humphrey Davy had found out how to save copper sheathing from corrosion, by means of zinc protectors; but subsequent experience showed that, in proportion as the copper was thus electro-chemically preserved, it was rendered more liable to be *fouled* by the adhesion of animal and vegetable substances—an evil scarcely inferior in magnitude to that of the destruction of the copper itself; and farther than the point so reached by Davy, science had not advanced, when the first iron ship was launched into the deep. Much was at one time said of certain patented processes of zincing, by which it was alleged iron could be so thoroughly coated, as not to leave a speck unexposed for air or water to act upon—and much was hoped from them; but one after another they all proved decided failures. In the best zinced sheets of iron produced by these processes, there were always found a number of spots which had been left bare, by the collection of rust on which, the protective power of the zinc, in respect to the remainder of the iron, was almost entirely neutralized. Of "anti-corrosive" and "anti-barnacle" paints and varnishes there had been also an abundance, both before and since the

days of Davy, but not one which could be said to have survived the test of practice, or which was not, more or less, of an empirical character.

So matters stood—that is to say, about the time of iron first coming into extensive use for the construction of ships—when the British Association were induced to take up the question, as one of the most practically important of the day, and to devote a portion of their funds to the institution of a series of experiments in relation to it, under the direction of Mr. Robert Mallet, of Dublin, a gentleman eminently fitted, by practical habits and experience, as well as by scientific knowledge, to do justice to the task intrusted to him. The details and results of these experiments are related in two reports made by Mr. Mallet to the Association, and published in their Transactions: and though they go little farther than to show the defects of existing processes, (that of zincing more particularly,) they must be allowed to have accomplished a most valuable service, in having cleared the subject from the vast mass of false science and erroneous practice by which it had become encumbered.

Mr. Mallet, following out the course of investigation thus auspiciously commenced, has since happily mastered all the difficulties of the case, and devised a series of remedial processes with so much of science, and therefore of sufficient reason, in them, as to leave no doubt on our minds of their perfect efficiency. To indicate briefly Mr. Mallet's discoveries, they may be said to consist, *first*, in a method of zincing iron so perfectly, that not a spot of the iron is, or can be, left unprotected; *second*, in a method of protecting iron and other metals by means of palladium, (at a moderate cost,) which renders them as incorrodible by air and moisture as palladium itself (*palladiumizing*, it may be called, with as much propriety as we say, *zincing*, or *gilding*, or *soldering*;) and, *third*, in a new paint, to which, from its life-destroying properties, Mr. Mallet has given the name of *zoofagous* paint, by the application of which to vessels, whether of wood or iron, or with whatever material they may be sheathed, *fouling* is rendered impossible. The following details of these processes, which we have great pleasure in being the first to lay before the public, we extract from Mr. Mallet's specification, which has been just enrolled.*

1. *The Zincing Process.*

Supposing the articles about to be zinced, are plates and ribs of iron, intended to be employed in the construction of an iron vessel, they are first carefully cleaned from all adhering oxide. With this view they are immersed edgewise in a suitable vessel of wood, pottery, stone, or lead, containing dilute sulphuric acid of the specific gravity of about 1.300 at 60° of temperature, or dilute hydrochloric acid of the specific gravity of about 1.060 at 60° of temperature, formed by diluting these acids respectively as they are usually found in commerce with rather more than an equal bulk of water. As it is of importance that the scales of oxide should be detached as rapidly as

* Enrolment Office, January 7, 1842.

possible, the diluted acid should be warmed; and this may be conveniently effected by means of a steam jacket round the vessel, or by blowing steam into the acid; the acid vessel, or "Cleansing Bath," as it may be termed, should be so constructed for operations on a great scale, that the lower portion of the acid, and the scales which are precipitated, can be occasionally withdrawn to prevent waste of acid, or the cleansing process from being inconveniently protracted. The iron must be wholly, not partially, immersed, and the bubbles of gas formed on its surface must be free to ascend in the fluid and escape. As soon as the scales of oxide have become detached, or loosened, the articles are to be removed from the "cleansing bath," thrown into or washed with cold water, and struck or hammered to shake off and detach the scales. In the case of flat boiler plates, they may be advantageously passed backwards and forwards, through the machine known to boiler makers as "a mangle." The surfaces of the iron are then to be thoroughly scoured, by hand or by any suitable machinery with sand or emery, or with pieces of grit stone, while exposed to a small running stream of water, until they appear quite clean and of a bright metallic lustre. The articles are now, before being allowed to dry, to be plunged into a "preparing bath," consisting of the following mixture: A saturated cold solution of chloride of zinc is made by dissolving zinc or its oxide in hydrochloric acid; to this is added an equal bulk of a saturated cold solution of sal ammoniac; and to the mixed solutions as much more sal ammoniac in the solid state is added, as they will dissolve. Or, these solutions may be made and mixed hot, and the solid sal ammoniac then added, but the addition of some cold water will then be requisite to dissolve the whole of the salts so formed. The bath may also be formed of sulphate of zinc and sulphate of ammonia, or acetate of zinc and acetate of ammonia, or of any other soluble salt of zinc and ammonia or salt of manganese and ammonia. The nitrates of zinc and ammonia are the least advantageous, and it is stated that none answer the purpose so well as the chloride of zinc and sal ammoniac first before directed to be used. No free acid should be present in these solutions. As soon as the surfaces of the immersed articles appear covered all over with minute bubbles of gas they are then in a fit state for combining with the metallic alloy with which they are next directed to be coated; but they may be allowed to remain in the preparing bath for any convenient length of time without injury or prejudice to the subsequent processes. The metallic alloy last referred to is prepared in the following manner: A quantity of zinc is melted in a suitable vessel (one formed of pottery or stone is found to answer best,) and when it is in a state of fusion, mercury or quicksilver is added, in the proportion of 202 parts of mercury to 1292 parts of zinc (both by weight) being in the proportion of one atom of mercury to forty atoms of zinc, both upon the hydrogen scale. The two metals are well stirred or mixed together with a rod of dry wood or of iron coated with clay; and when this has been done there is added one or the other of the metals know to chemists and others as potassium and sodium (the metallic bases, of which the well known alkalies potash and soda, are oxides) in the proportion of a

pound or thereabouts of potassium or sodium to every ton weight of the alloy of zinc and mercury, or in some cases less will suffice; either potassium or sodium will answer the purpose, but Mr. Mallet prefers the latter, as more easily obtained and more manageable. Whether it is potassium or sodium which is used, it is removed from the naphtha, or other fluid in which it is customary to keep these metals in order to preserve them from oxidation, in small portions of not more than half an ounce at a time, and by means of a small inverted cup of wood, formed on the end of a stick, thrust rapidly below the surface of the alloy of zinc and mercury, so as to avoid any waste or combustion of the alkaline metal. A triple alloy is thus formed of zinc, mercury, and sodium or potassium, which having been again stirred and mixed with the rod of dry wood, or of iron coated with clay, is now ready for covering or coating the prepared iron. The combination of these metals is facilitated, and their oxidation on the surface retarded, by pouring upon their fluid surface some of the liquor of the preparing bath, or strewing upon it some of the salts dissolved in that liquor in a dry state.

The plates or ribs of iron are now to be taken up out of the preparing bath, permitted to drain for a few seconds, and while still wet with the liquor of the preparing bath, immersed in the triple alloy in a state of fusion. As soon as they have acquired the temperature of the bath of alloy, they are to be withdrawn from the metallic bath edgewise or endwise, when they will be found covered with a perfectly uniform and coherent coat or surface of the alloy. The affinity of this alloy for iron is, however, so intense, and the peculiar circumstances of surface as induced upon the iron presented to it by the preparing bath are such, that care is requisite lest by too long an immersion the plates are not partially or wholly dissolved. Indeed where the articles to be covered are small, or their parts minute, such as wire or nails or small chain, it is necessary before immersing them to permit the triple alloy to dissolve or combine with some wrought iron, in order that its affinity for iron may be partially satisfied and thus diminished. At the proper fusing temperature of this alloy, which is about 680° Fahr. it will dissolve a plate of wrought iron of an eighth of an inch thick in a few seconds. No sputtering is produced by the immersion of the iron wet from the preparing bath into the alloy; but care is to be taken that there are no hollow places or cavities in the articles immersed which the alloy cannot wholly fill; lest in such case steam may be generated below the surface of the metal, and a dangerous explosion be thereby occasioned. It is stated to be desirable that the melting vessels should be as deep and expose as small a surface as the nature of the articles to be immersed will allow. At the moment of immersion of the articles, the surface of the alloy is to be cleansed of all dross or oxide by a wooden skimmer. As soon as the iron plates or ribs are withdrawn from the alloy or "Metallic Bath," they are to be plunged into cold water and well washed therein. The surface of the iron is now in a condition permanently to resist corrosion and oxidation in air, or in salt or fresh water.

All the foregoing operations are best performed upon the plates or

ribs after they have been bent and fitted to their places, and the plates have been riveted together into large pieces of eight to ten feet square or more. When again put "into frame," or placed in their respective positions in the ship's hull, they are directed to be united by rivets countersunk from the outside, and consequently headed inside the vessel. The countersunk heads of these rivets are to be also coated with the triple alloy in the manner before described, and tongs of iron are to be provided, having a very large mass of metal in their jaws, between which a hollow seat, of the shape and size of the countersunk rivet head, is to be formed to receive it. An alloyed rivet being seized by a pair of such tongs may have its point heated to a riveting or welding heat without injuring the coat of alloy upon its countersunk head; for the heat is carried off from the latter so fast by the contact of the large mass of iron in the jaws of the tongs, which are to be cooled occasionally, as to prevent the head of the rivet becoming hot during the heating of the point in a common smith's fire.

The hull of the iron vessel, being thus completed, and wholly covered with the alloy, is then to receive a coat of varnish all over, of either of the compositions about to be described. If possible, this varnish should be laid on with a spatula or thin flexible blade of horn, or some such material, as a brush produces minute air bubbles, which leaves spaces uncovered on the drying of the varnish. The varnish will dry, or get hard and coherent, at ordinary temperatures; but when practicable, it is desirable to expose it for some hours to a temperature of about 300° Fahrenheit, which gives it greater adhesion and durability. The iron surfaces may be warmed in successive portions by heat radiated from "chauffers" or open fires of coke, or by any other convenient means. The varnish may be either of a composition, which Mr. Mallet terms No. 1, or of another, which he terms No. 2. The composition No. 1, is formed as follows:—Take 50 lbs. of foreign asphaltum, melt and boil it in an iron vessel, for three or four hours; add gradually 16 lbs. of red lead and litharge ground together to a fine powder in equal proportions, with 10 imperial gallons of drying linseed oil, and bring all nearly to a boiling temperature. Melt in a separate vessel eight pounds of gum anime (which need not be of the clearest or best quality;) add to it two imperial gallons of drying linseed oil, boiling, and twelve pounds of caoutchouc softened, or partially dissolved by coal tar naphtha (as practised by the makers of water-proof cloths.) Mix the whole together in the former vessel, and boil gently until, on taking some of the varnish between two spatulas, it is found tough and ropy. When this "body" is quite cold it may be thinned down, with from 30 to 35 gallons imperial of turpentine, or of coal naphtha, which will make it ready for use. Mr. Mallet states this to be the best varnish he is acquainted with for this purpose. It is not acted on when dry and hard, by any moderately diluted acid or caustic alkali; it does not by long immersion combine with water, and so form a white, and partially soluble hydrate, as all merely resinous varnishes and all oil paints do; it is, moreover, so elastic, that a plate covered with it may be bent for several times without its peeling off. And, lastly, it adheres so fast, that nothing

but a sharp edged instrument will scratch it off the surface of iron. The composition No. 2 is of a cheaper sort, but not quite so good. Common coal or gas tar is to be boiled in an iron caldron, at so high a temperature, that the smoke from it is of a yellow dun colour; or the tar is to be caused to flow through red-hot iron tubes. The boiling passage through the tubes is to be continued until the residue is a solid asphaltum, breaking with a pitchy fracture. It is essential that the boiling should be carried on at this high temperature, as the permanence of the varnish in water depends upon the tar having been submitted to the temperature at which naphthaline is formed, by the decomposition or breaking up of the original constitution of the tar. Take 56 lbs. of this coal tar asphaltum; melt it in an iron vessel: add ten imperial gallons of drying linseed oil, ground with twenty-five pounds of red lead and litharge, in equal proportions; add to the whole, when well mixed, and after boiling together for two or three hours, fifteen pounds of caoutchouc, softened or partially dissolved by coal naphtha, as before described; and when cold, mix with from twenty to thirty gallons of turpentine, or coal naphtha, which will make the varnish ready for use.

[TO BE CONTINUED.]

TRANSLATED FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Fabrication of Gas for lighting from Soap-suds employed in cleansing stuffs. *By* M. HOUZEAU MUIRON.

A few years ago the immense quantity of soap-suds employed in the city of Rheims in preparing woollen stuffs was entirely lost. M. Houzeau Muiron conceived the idea of extracting from them the fatty matter, and of making an important application thereof. In fact, by submitting them to a regular purification, he has obtained a limpid oil, with which he succeeds in preparing the soaps in demand in commerce, while the residue of this purifaction serves for the advantageous production of a gas for lighting a part of the city.

The soap-suds collected in the shops, where they have become saturated with grease and the impurities of the tissues, are poured together into a large basin which is capable of containing about 3,000 gallons. To decompose them, there is poured upon them 308 pounds of muriatic acid, or 154 pounds of sulphuric acid, first diluted with its own weight of water, and the mass is rapidly agitated until the decomposition is complete.

Shortly afterwards a froth is seen to form, which at the end of twelve or eighteen hours is sufficiently well separated from the water upon which it floats. Four-fifths of this water is then run off, containing about one per cent. of sulphate of potassa which is utilized either by evaporating it in drying-houses, or by running it off upon dry earth exposed to the air, which when sufficiently charged with the salt is washed. Directly after this operation, the basin is filled again with a fresh portion of soap-suds, which float the fatty matter and permit it to be run off into a side tub. The product obtained is a

mixture of unaltered oil, the acids, animal matters and a large quantity of water which forms with them a species of hydrate. This water is disengaged by injecting several times into the mass a current of steam which heats it and facilitates its evaporation. The fatty matter is then run off into a boiler where it is submitted to a rapid ebullition, aided by continual agitation, which drives off the last portions of water. The product contains twenty or twenty-five per cent. of impure matters which colour it and render it turbid. To purify it, it is poured into basins of copper and mixed with two per cent. of concentrated sulphuric acid. After two days the limpid oil comes to the surface, while the impurities are precipitated to the bottom.

The oil is carefully separated, and the deposit, when filtered through cloths in a press, gives still a large quantity of oily products, which are added to the preceding and made into soap by treating them with common soda.

The residuum is black and very thick; from it M. Howzeau produces the gas for lighting, but before introducing it into the retort, he liquifies it by means of the empyreumatic oil obtained in the preceding operation.

The gas thus prepared is purified by lime, and the water from the washing contains sufficient cyanide of calcium for the preparation of Prussian blue from it, by treating it with sulphate of iron and washing the precipitate with muriatic acid.

This gas possesses a considerable lighting power, and in order to apply it to the lighting of the establishments scattered throughout the city of Rheims, M. Houzeau has contrived a manner of transporting it, at the same time simple, economical and free from danger.

F. Boudet.

Jour. de Pharm. et de Chim., May, 1842.

Robert Stephenson's *New Locomotive.*

With the progress of the locomotive engine, it has, like other machines of extensive use, attained that period when its economy becomes of the greatest importance. Influenced by such considerations, Mr. Robert Stephenson has directed his attention to a less consumption of fuel, and to effecting a more simple arrangement of the machinery, both of which points have been well managed in his new engine now running on the York and North Midland Railway.

Economy in the consumption of fuel has been obtained, by adding considerably to the length of the tubes, without increasing the distance between the front and back axle of the engine; consequently the space occupied by the engine upon the bearing is precisely the same, therefore no alterations are requisite in the turn-plates, or other arrangements made for the accommodation of the ordinary locomotives. The machinery is simplified by placing the axles of all the wheels under the cylindrical portion of the boiler, the axle of the front wheels being placed close to the smoke box, and the axles of the hind wheels close to the foremost end of the fire box, instead of the back part. This arrangement allows the axle of the driving wheels to be placed in the

centre of the other two axles, or at such intermediate distance as may be found the most suitable for the moving parts.

The alteration in the construction of the boiler and tubing gives a heating surface of 800 superficial feet, whereas in the ordinary engine it rarely exceeds 450 feet, being for the new plan a superiority of fully 350 feet. Such is the effect produced by this addition, that the temperature of the air escaping in the chimney scarcely exceeds the temperature of the water in the boiler; a circumstance which has a farther beneficial effect beyond the economy of fuel, for it has been found, by increasing the extent of heating surface, and employing usefully the whole of the heat generated in the fire, that a less violent draught of air is required; the consequence is that very few hot ashes are thrown out of the chimney; this peculiarity is quite remarkable in the engine now running. A few days since, a journey of ninety miles was performed by this engine, during which no ashes were thrown out of the top of the chimney, and at the same time the accumulation in the smoke box was very trifling, not exceeding a fourth of the usual quantity. As the tendency to eject ashes from the chimney is dependent upon the speed, it is necessary to state, that the speed was never below twenty miles per hour, generally exceeded thirty, and for several miles a speed of forty-eight miles per hour was uniformly attained, with five loaded coaches.

The consumption of fuel during the above experiment was 19.2 lb. per mile, with a load of eight coaches over half the distance (forty-five miles,) and five coaches over the remaining half. This consumption includes the whole of the fuel used in lighting the fire and raising the steam.

We may truly say, that we have never witnessed an instance where speed and economy were combined to the same extent; indeed, under no circumstances have we heard of the consumption of fuel being reduced to so low a figure. It must, however, be borne in mind, that this result is from a single experiment, and that we must not be deluded by isolated trials; but we are glad to hear that on the line where the engine is now working, the Company have ordered an accurate record of the performance, and quantity of fuel consumed during each trip, which we hope will be made public.

Mr. Stephenson has introduced tubes of wrought iron, instead of brass or copper, in order that the increased heating surface might be obtained without a corresponding augmentation in the price of the engine. This he has not adopted without making several experiments. During the last twelve months, he has had several boilers working under his own eye with iron tubes, for the special purpose of determining how far he could recommend them for general adoption. The result has been all that he could desire; and it is owing in some degree to this, that he has introduced them with greater confidence.

Having now described the modification in the boiler, we shall proceed to point out Mr. Stephenson's alterations in the mechanical arrangement. In the ordinary engines, the mechanism for working the slide valves is very liable to derangement, and considerable wear and tear. This part of the engine he has so far simplified, as to require

only a simple connection between the eccentrics and slide valves, thus doing away with a considerable number of moving parts, which have hitherto given rise to more casualties than any other part of the ordinary engine. This is attained by placing the slide valves vertically on the sides of the cylinders, instead of on the top, as heretofore, so that the direction of the sliding motion of the valves, and the central line of the valve rods, will intersect the central line of the main axle, at the point where the eccentric is placed. In this case, the eccentric rods are connected immediately to the prolongation of the valve rods, without the usual intermediate levers and weigh bars; besides, the slide valves of both cylinders are placed in one steam chest, between the cylinders.

Another improvement is that effected in the working of the feed pumps: it consists in connecting the pump rods to the eccentrics used for reversing the engine. By this arrangement, the velocity of the moving part of the pump is greatly dimished, by which is secured greater regularity in action. In addition to what we have already described, there are several minor alterations, which we cannot fully explain without giving detailed and elaborate drawings.

The following are the principal dimensions of the engine now working on the York and North Midland Railway:—

Diameter of cylinder - - -	14 inches.	
Length of stroke - - - -	20 "	
Diameter of driving wheels - -	5½ feet.	
Ditto of small ditto - - - -	3 "	
There are 150 tubes, giving a heating surface of		765 feet
Copper fire box, with a heating surface of - -		30 "
Total heating surface		795 feet.
Length of boiler, including fire and smoke boxes		17 feet.
Weight of the engine in working order		15 tons.

Civ. Eng. & Arch. Jour., Feb. 1842.

A New Cement, a substitute for Glue and Caulking.

Amongst the numerous inventions submitted to the Lords Commissioners of the admiralty, and referred by their Lordships to the committee of master shipwrights recently sitting at Woolwich dockyard, was a composition to be used in place of the substance with which vessels are at present caulked to render them water-tight. The experiments ordered to be made by the master shipwrights to ascertain its value when applied to the purpose for which it is intended, and the result, are interesting and satisfactory. Two pieces of African teak, a species of wood difficult to be joined together by glue, on account of its oily nature, had a coating of the composition applied to them in a boiling state, and in a short time afterwards bolts and screws were attached to each end, the joined wood placed in the testing-frame, and the power of Bramah's hydraulic engine applied to the extent of nineteen tons, when the chain broke without the slightest strain be-

ing perceptible where the jointing took place. A larger chain of one inch and a half in diameter was then applied, which broke with a strain of twenty-one tons, the joint in the wood remaining apparently as firm as at first. The utmost strain the cement can bear in this form, therefore, remains to be proved when experiments are made with larger chains. Four pieces of hard wood were then joined together, weighing in one piece forty-four hundred weight, and carried to the top of the shears in the dockyard, a height of seventy-six feet, from which it was precipitated on the hard granite wharf wall below, without any of the joints yielding in the smallest degree. The results of these severe tests induced the Lords Commissioners of the Admiralty to communicate with Lieutenant-General Sir George Murray, G.C.B. and G.C.H., for the purpose of making experiments with it in the marshes at Woolwich, by bringing the full force of cannon balls against it. Accordingly, a number of planks of oak eight inches thick and fir sixteen inches square, were joined together with the cement, to together eight feet in height and eight feet in length of the side of a first rate ship of war, without any thing else in the shape of bolt or security to assist the composition; and it was set up as a target at the butt in the marshes; when a number of officers of the Royal Artillery were present to witness the experiment. Three shots were first fired, every one entering the target, the third in a direct line with the bull's-eye within three inches of its outer circle. The effect of these shots were wonderful, they tore the wood to pieces, and excepting in one instance, where the joint had not been good, they had no effect upon the cement. A hole six inches and a quarter in diameter was then bored in the centre of the target, and a thirty-two pounder shell inserted and exploded by a match, which tore the wood to small splinters without in many places in the least separating the composition. This new invention is said to possess the power of expanding like Indian rubber in warm climates, and will not become brittle under the coldest temperature. It appears to be a great favourite with naval officers, as it is so clean, having only the appearance of French polish. The name of the inventor is Mr. Jeffrey.

The substances of which *the cement is composed* are simple, being merely *shell-lac and Indian rubber dissolved in naphtha* in certain proportions; and being insoluble in water, the purposes to which it may be applied are numerous. Its value is about half the expense of common glue, the saving to the country by its universal adoption will be incalculable, as the inventor has been employed in experiments with it for upwards of two years, and has found that in the absence of great friction it is in a manner imperishable. An experiment was tried in the dockyard, which shows the value a supply of the cement will be of to vessels which may be damaged at sea. Eight pieces of wood were joined together in the form of a mast, and a strain applied to them and to another mast of one piece of wood. The latter gave way first, and the other only broke after being considerably bent and the application of a rather great strain. By this substance, therefore, it is certain that ship carpenters can have no difficulty in effecting repairs at sea, which could not be done under any other circumstances.

Ibid., June, 1842.

Dreadful explosion of a Steamer and Melancholy Loss of Life.

Our readers are aware that a fine fast-sailing steamer named the *Telegraph*, was lately built for the river trade, for the purpose of competing with the railway. She has been plying for some time back, and being on the high pressure principle, has beaten the swiftest steamers in the passage to Greenock. To-day, about half-past 12, the people on the steamboat quay, Greenock, heard a report as if a battery of cannon had been discharged at Helensburgh, (a distance of four miles.) A smoke was seen to arise, and telescopes being procured, the explosion of the *Telegraph* was immediately discovered. Two of the tug steamers lying at Greenock quay got their steam up, and sailed for Helensburgh, to render whatever assistance they could. On arriving at Helensburgh they found that the *Telegraph's* boiler had exploded, and that the hull of the vessel was a total wreck, and literally floating away in pieces. At the time our informant left, it had been ascertained that thirteen had been killed outright, but as strangers were on board, it was impossible to arrive at a true statement of the casualties. A number of persons were seriously wounded, some of whom are not expected to recover, and among the latter we are sorry to say is Captain Ewing, late of the Kilmun steamer, who was just alive when our despatches were sent off. It appears that the passengers for Helensburgh had all landed, and that the boat was about to proceed on her passage up Gairloch when the explosion took place. Something connected with the management of the valves is supposed to have caused the accident. Let this be as it may, we are inclined to think that the melancholy loss of life will be the means of putting an end to the high pressure system of propelling steamers on the Clyde. We have heard that four of the dead belong to Glasgow, and formed a part of a company of eight painters who had gone down to paint a house on the banks of Gairlock. Mr. Hedderwick, of the late firm of Hedderwick & Co., shipbuilders, is among the missing.—*Glasgow Chronicle, March* 21.

Railway Mag. March, 1842.

Vapours in Smelting Furnaces.

M. Eblemen read a memoir before the Paris Academy of Sciences, Feb. 1, on the nature of the various vapours developed in smelting furnaces, as observed at different altitudes within the furnace. The object of such researches was to determine the degree of heat at various points, and to devise means for the improved regulations of the fires. He has arrived at the following results—1. The gaseous vapours, on coming out of a furnace heated by charcoal or wood, contain watery vapour, carbonic acid, and oxides of hydrogen and azote, but no carbonated hydrogen. At six or eight feet below the mouth of the furnace the watery vapour is not found, and the proportion of oxide of carbon increases, while those of hydrogen and carbonic acid diminish, according as the observations are made lower and lower down in the furnace.—2. When coal is used jointly with wood for heating the furnace, the carbonization of the vapours takes place in an internal zone, and the water is expelled from the metal at a very low altitude. He found that the proportion of gas which traverses a certain zone of the furnace per minute, is greater according as it is further from the bottom of the furnace.

Athenæum, Feb., 1842.